



## Addressing climate goals and the SDGs through a just energy transition? Empirical evidence from Germany and South Africa

Ramona Hägele, Gabriela I. Iacobuță & James Tops

To cite this article: Ramona Hägele, Gabriela I. Iacobuță & James Tops (2022) Addressing climate goals and the SDGs through a just energy transition? Empirical evidence from Germany and South Africa, Journal of Integrative Environmental Sciences, 19:1, 85-120, DOI: [10.1080/1943815X.2022.2108459](https://doi.org/10.1080/1943815X.2022.2108459)

To link to this article: <https://doi.org/10.1080/1943815X.2022.2108459>



© 2022 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.



[View supplementary material](#)



Published online: 11 Aug 2022.



[Submit your article to this journal](#)



Article views: 540



[View related articles](#)



[View Crossmark data](#)

## Addressing climate goals and the SDGs through a just energy transition? Empirical evidence from Germany and South Africa

Ramona Hägele<sup>a</sup>, Gabriela I. Iacobuță<sup>b</sup> and James Tops<sup>c</sup>

<sup>a</sup>Environmental Governance and Transformation to Sustainability, German Institute for Development and Sustainability (IDOS), University of Bonn, Bonn, Germany; <sup>b</sup>German Institute of Development and Sustainability (IDOS); <sup>c</sup>Tourism Policy and Analysis Unit, Junior Policy Analyst at the OECD Centre for Entrepreneurship, SMEs, Regions and Cities

### ABSTRACT

In striving to achieve the Paris Agreement and the 2030 Agenda, governments have the opportunity to implement their climate and sustainability goals more coherently. Such coherence requires the coordination of interdependent policies across different policy fields, sectors and actors. This paper explores how governments design and implement synergic solutions to concomitantly achieve both international agendas. With the empirical cases of Germany and South Africa, we investigate two independent approaches to the synergic solution of a just energy transition, whereby countries aim to phase out coal as a means to tackle climate change while also ensuring that the achievement of other Sustainable Development Goals (SDGs) is not hindered. Methodologically, we apply a deductive qualitative approach consisting of literature review, semi-structured interviews, and content analysis. To that end, we examine relevant policies and institutional arrangements by applying a combined conceptual framework of energy justice and just transition in both countries. We find major challenges in overcoming environmental, economic and social burdens of the coal phase-out, especially related to jobs and inequality (SDGs 8, 10) and the Water-Energy-Food-Land nexus (SDGs 2, 6, 7, 15). Through the selection of Germany and South Africa, we illustrate how countries with different political, social and economic backgrounds strive to manage such a transition. Our developed framework and case-studies' findings point towards important considerations when designing just energy transition pathways, such as ensuring inclusiveness in decision-making, thoroughly assessing social, economic and environmental impacts, and adequately coordinating across different actors and the local, provincial and national levels.

### ARTICLE HISTORY


Received 01 October 2021  
Accepted 22 July 2022

### KEYWORDS

Just transition; energy justice; SDGs; climate change; coal phase-out

**CONTACT** Ramona Hägele  [Ramona.Haegele@idos-research.de](mailto:Ramona.Haegele@idos-research.de)  Researcher at German Institute for Development and Sustainability (IDOS) and PhD Candidate at the University of Bonn

This article has been republished with minor changes. These changes do not impact the academic content of the article.

 Supplemental data for this article can be accessed online at <https://doi.org/10.1080/1943815X.2022.2108459>

© 2022 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

## I. Introduction

Meeting the Paris Agreement<sup>1</sup> goal of keeping average global temperature increase to well below 2°C above pre-industrial levels requires a deep and rapid transformation of the energy systems away from fossil fuels worldwide. Moreover, the 2030 Agenda<sup>2</sup> Sustainable Development Goal (SDG) number 7 calls nations to “ensure access to affordable, reliable, sustainable and modern energy for all” (UN General Assembly 2015p.19) by 2030. While these two international agendas are well aligned across some of their goals, leading to multiple synergies, the interlinked nature of the SDGs and the transformative nature of a low-carbon transition call for a careful accounting and management of potential trade-offs (Le Blanc 2015; Roy et al. 2018; Breuer et al. 2019). In that sense, the global energy transition to address climate change and sustainable development poses important justice challenges. Competing needs and priorities complicate efforts to steer societies towards low-carbon transformations, in particular in the energy sector with its tightly coupled carbon–development relationship (Spencer et al. 2018). As the COVID-19 crisis set back climate action around the globe through delayed climate negotiations and carbon-intensive recovery measures (Hägele and Mathis 2020; Hepburn et al. 2020; Meles et al. 2020), identifying actionable synergic solutions that can jointly address climate and sustainable development is more important than ever (Matthews et al. 2020; Matthews and Tokarska 2021).

Potential trade-offs and synergies of the energy transition are linked to all SDGs (Roy et al. 2018). A particularly pertinent example of these complex interactions is the Water-Energy-Food-Land (WEFL) nexus (relevant to SDGs 2, 6, 7, 15). Within the WELF nexus, water secures food production through irrigation, and energy production through cooling of power plants and hydro energy. At the same time, agriculture requires energy for water pumping and competes with biofuel production for land (WEF 2011; Weitz et al. 2017; Dombrowsky and Hensengerth 2018; Pahl-Wostl 2019; Mahlknecht et al. 2020). Moreover, important questions related to inequality and justice (SDGs 5, 10, 16) emerge as the energy transition may have positive or negative effects on jobs and economic activities (SDG 8), energy security (SDG 7), responsible production (SDG 12), health (SDG 3) and environmental pollution (relevant to SDGs 3, 6, 12, 14 and 15) (McCollum et al. 2018; Nerini et al. 2018). As a result, energy transition issues ignited several mass demonstrations in recent years, both in countries of the global South and global North. For instance, France’s carbon tax hikes on petrol, diesel, heating oil and natural gas caused social justice anger because of the disproportionately high burden on poorer households (SDG 1), leading to the “yellow vests” protests in 2018 (Gagnebin et al. 2019). In Germany, activists of Fridays For Future and Extinction Rebellion occupied the western brown coal district Garzweiler to protest against the expansion of the lignite mining area and related forced resettlements and deforestation (SDGs 10 and 15) (Buchsbaum 2019). Similarly, in South Africa, national unions of mining and metal industry have marched in capital Pretoria urging for a just energy transition (SDG 8) (Gedye 2018).

One essential measure to meet the Paris Agreement’s global temperature target will require the early retirement of the coal sector. While this transition will bring about substantial improvements to the environment across many dimensions, as well as social and economic benefits, it will also introduce a broad range of policy challenges on both the demand and supply sides of the coal industry. In coal-dependent countries, policy

makers will need to address potential trade-offs related to loss of local jobs, a reduction in domestic revenues (from coal exports), stranded assets, or high electricity prices (NCE 2018).

In recognition of these important challenges of the energy transition, the key concepts of “energy justice” and “just energy transition” have become highly prominent in recent years (Heffron and McCauley 2018). In this paper, in line with Jenkins et al. (2016) and Sovacool and Dworkin (2015), we understand “energy justice” as a goal of achieving equity in the global energy system by taking into account social, economic, environmental, and political effects of participating in this system, whereas we conceive “just energy transition” as the process of achieving such equity while “moving towards a post-carbon society” (McCauley and Heffron 2018, p.2).

Previous studies have addressed the issues of “energy justice” (Sovacool and Dworkin 2015; Jenkins et al. 2016) and “just transition” (Newell and Mulvaney 2013; Heffron and McCauley 2018) both theoretically and empirically, through country case studies (Swilling et al. 2016; Greenberg 2018; Brauers and Oei 2020). Most studies have focused on linking environmental, social and energy justice concepts. Evans and Phelan (2016) combined environmental justice and just transition discourses particularly addressing the coal phase-out in a coal mining and exporting region. McCauley and Heffron (2018) introduced just transition as an integrative approach of climate, energy and environmental justice. Further research by Heffron & McCauley provided a critical review of energy, environmental and climate justice by applying legal geography (Heffron and McCauley 2018) and an overview of the energy justice concepts in research and practice analysed through educational sciences (Heffron and McCauley 2017). Energy justice and just transition were further conceptualised by Sovacool and Dworkin (2015) and Jenkins et al. (2016) explaining the three tenets of justice, i.e. distributional, recognition and procedural, as well as by Pellegrini-Masini et al. (2020) who conclude that the energy justice concept needs to pass from a theoretical to a policy implementation phase. Other studies have tried to link the just transition concept to the 2030 Agenda and the Paris Agreement. Galgóczi (2018) for example examines the implications of the Paris targets of the European Union (EU) for the labour market. Jenkins et al. (2020) review the link of the just transition to the Paris Agreement and specifically to the Nationally Determined Contributions (NDCs). Moreover, research on the interlinkages of the just transition and the SDGs have predominately focused on SDG 7 (Villavicencio Calzadilla and Mauger 2018; Müller et al. 2021). Yet, these studies have not addressed the potential synergies and trade-offs of a just energy transition with sustainable development and climate goals, as well as the political and economic realities in respective countries, e.g. how countries with limited social safety nets and high dependence on fossil fuels, and in particular coal, manage a just energy transition.

Most country case studies in the field have only focused on countries of the global North and OECD countries (Pai et al. 2020), such as Australia (Snell 2018), Ireland (Mercier 2020), Greece (Nikas et al. 2020), Poland (Brauers and Oei 2020; Janikowska and Kulczycka 2021), the United States (Pollin and Callaci 2019) and the United Kingdom (Robins et al. 2020) or on regional case studies, e.g. Europe (Sovacool et al. 2019; Pianta and Lucchese 2020). Research on the just energy transition in the global South has predominantly concentrated on labour and associated inequalities, e.g. in India (Roy et al. 2019) or South Africa (Cock 2019) or on the socio-political implications of such a transition, e.g. in Colombia (Torres 2019), Sri Lanka

(Theiventhran 2022) or Mexico (Mejía-Montero et al. 2020). A few country comparisons have dealt with either national just transition policies in e.g. China, the European Union and the United States (Zhu et al. 2021) or with community ownership of local energy transitions in e.g. Italy, Indonesia and Australia (Sarrica et al. 2018). Yet, country comparisons that elucidate different approaches and needs by taking into account countries' socio-economic and political contexts have remained limited. Healy & Barry (2017, p.451) for example "call for greater recognition of the politics, power dynamics and political economy of socio-technical energy transitions" as perceived socio-economic costs of decarbonizing policies can hinder democratic/ popular support. Moreover, recent literature has highlighted the need to address energy justice and just transition concepts in an integrated manner (Evans and Phelan 2016; McCauley and Heffron 2018). Similar to Pellegrini-Masini et al. (2020), Heffron and McCauley (2017) concluded that there exists the need for the development of a common approach of the energy justice concept to put it from theory to practice.

Thus, the motivation and novelty of our study is in addressing above-mentioned research gaps by combining a theoretical and practical approach of energy justice and just energy transition and applying it in a comparative analysis of two coal-dependended countries, Germany and South Africa. Hereby, we showcase how our framework can guide country-specific needs in implementing a just energy transition and explore how the two selected country cases addressed the key elements of this framework in their endeavours to phase out coal. Acknowledging the complexity and variety of country contexts, we chose two countries with diverse social, economic and political backgrounds, one from the global South and one from the global North. Moreover, this choice of countries is particularly timely and pertinent in view of the recently established landmark international Just Energy Transition Partnership (at the 26th Conference of Parties in November 2021), which aims to support South Africa's coal phase-out and is strongly supported by Germany among other members (COP26 2021). Our paper unfolds as follows: First, we explore the concepts of "energy justice" and "just transition" and indicate how they can be applied to identify and to address key challenges between climate and sustainable development in the energy transition. In doing so, we provide a framework that can be used by both researchers and policymakers working on the just energy transition topic theoretically and practically. Second, we apply these combined concepts to our country case studies, conducting an analysis based on semi-structured interviews, key national policies and academic literature. We present the results of this analysis both individually, and as a comparison of the two case studies, aiming to support research, policy and institutional learning between the two countries. Finally, we discuss the potential of the "just energy transition" as a synergic solution and outline a way forward for future research and policy development.

## **II. Conceptual and methodological framework**

This chapter explores the concepts of "energy justice" and "just transition" and develops an integrated framework to demonstrate how the two concepts can be jointly applied by governments to successfully implement energy transitions and thereby contribute to simultaneously achieving the 2030 Agenda and the Paris Agreement. After introducing the two concepts, we showcase our framework, followed by outlining our research design and methodology, as well as our rationale for the selection of country case studies.

### **Energy justice: evaluative and normative contributions**

To tackle the important questions and challenges of the energy transition, the concept of energy justice as a strand of academic research, bringing together philosophy and energy studies, grew in prominence in recent years (Heffron and McCauley 2018). Some of the questions that this strand addresses include procedural concerns such as a lack of appropriate representation in decision-making, how such an approach can lead to major trade-offs, and how it can generate unequal distribution of costs and benefits in energy systems (SDGs 7 &10) (Sovacool and Dworkin 2015).

Jenkins et al. (2016) bring together these overarching concerns of energy justice and present them as three tenets of justice in a conceptual framework that includes an evaluative and a normative dimension:

- *Distributional justice* investigates where injustices emerge, e.g. communities affected by the closure of a coal-fired power station (SDG 10), and “represents a call for the even distribution of benefits and ills on all members of society regardless of income, race, etc.” (Jenkins et al. 2016, p.176), hence referring to effects on all SDGs and how those affect different groups. It poses the evaluative and normative questions: Where are the injustices? How should we solve them?;
- *Recognition-based justice* considers which parts of society are ignored or misrepresented in policy decisions, e.g. ethnic minorities or aging populations, how to avoid related injustice and the loss of valuable knowledge of marginalized groups (SDGs 5 and10). It poses the questions: Who is ignored? How should we recognise?; and
- *Procedural justice* explores access to decision-making processes and the degree of engagement between decision-makers and communities through local knowledge mobilisation, information disclosure and better institutional representation (SDG 16) (Jenkins et al. 2016). It poses the questions: Is there a fair process? Which new processes to have?

In this study, we apply the tenets of energy justice to the context of our country case studies to identify key challenges of coal phase-out and how they are currently addressed through policies and institutions. To add a practical approach to these theoretical concepts and to close research gaps of combining theory and practice, we consider the just transition framework developed by the International Labour Organization (ILO) which is outlined in the following section.

### **Just transition: a practice-oriented approach**

Socio-economic effects of energy transitions have kindled calls to ensure that such transitions are “just”. The concept of “just transition” originated from the 1980s when labour unions demanded justice for workers and called for minimizing socio-economic disruptions in industries that were strongly affected by environmental laws (Stavis and Felli 2015; Goddard and Farrelly 2018). Over time, just transition became broader for unions and their partners and today unions are tying just transition specifically to climate action and sustainable development.

The concept of just transition is underpinned by justice theory, as fairness, equity and trade-offs between competing needs and priorities are addressed (Newell and Mulvaney 2013). Especially in the context of rapid energy transitions, energy policy decision-makers are confronted with interests of elites and powerful actors as well as the livelihoods and energy needs of affected communities (SDGs 7 & 10). Here, questions of justice and equity are central to the socio-technical transitions debates (Jenkins et al. 2016; Heffron and McCauley 2017; McCauley and Heffron 2018).

Importantly, just transition is increasingly featured in policy and political discourses nationally and internationally. The Paris Agreement addresses just transition and quality job creation explicitly (UNFCCC 2016). Moreover, at the 24th Conference of Parties (COP24), the “Just Transition Silesia Declaration” was signed by about 50 countries emphasizing the necessity to ensure social safety of workers and to create decent jobs (SDG 8) (COP24 2018) and at COP26, South Africa and supporting nations set a new precedent with the Just Energy Transition Partnership (COP26 2021).

In view of these discourses and needs, the ILO launched a just transition framework to facilitate policy coherence around transition measures. This framework provides guidelines for national governments to ensure a just transition, recommending

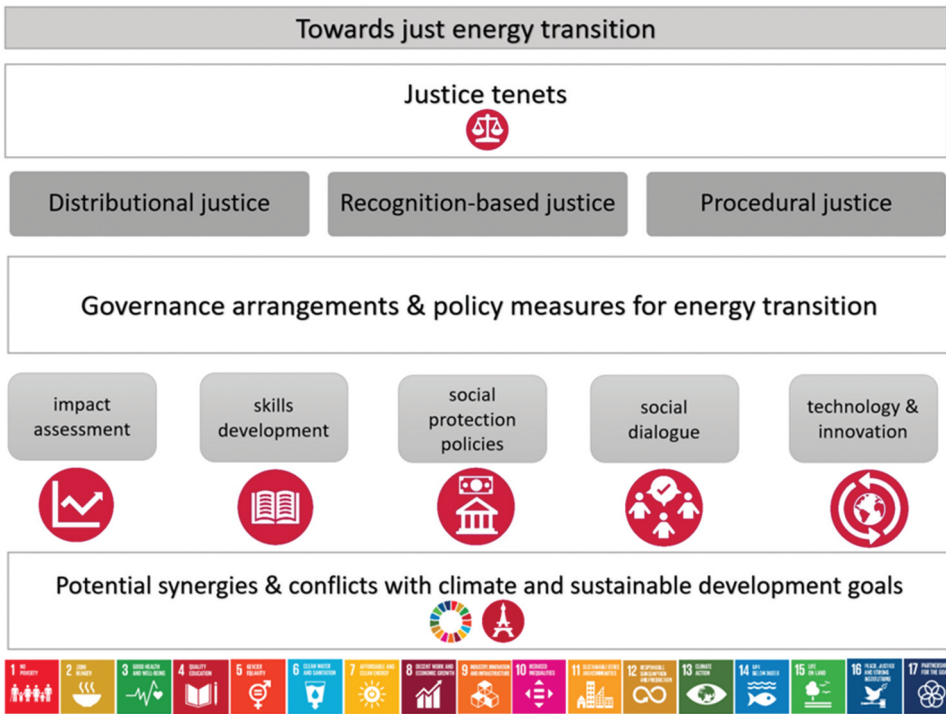
- (1) an inclusive social dialogue to achieve strong social consensus and transformation while avoiding major socio-economic disruptions (SDGs 10 and 16),
- (2) employment, social and economic impact assessments, including green jobs potential (SDGs 1, 8, 10 and 12),
- (3) skills development and supportive measures for job transitions, green job creation for all genders, and environmentally sound enterprises (SDGs 4, 5, 8, 9, 12, 14 and 15),
- (4) social protection policies that safeguard workers and vulnerable groups (SDGs 1 and 10), and
- (5) technology and knowledge transfers to developing countries, innovation and responsible investments (SDGs 8, 9, 12 and 17) (ILO 2019).

### ***Just energy transition framework***

In this study, we combine the theoretical knowledge on “energy justice” with the practical consideration of a “just transition” to develop a framework that outlines directions for a “just energy transition” and that enables a systematic assessment of opportunities and blind spots in current national policies. This framework is presented in [Figure 1](#) and we further outline its functionalities below.

The three tenets of energy justice are directly addressed by ILO’s five commitments for a just transition: Distributional justice is addressed through the assessment of employment, social and economic impacts of transitions. Moreover, skills development and measures to enable transitions in labour markets are connected to both distributional and recognition-based justice since the commitment contributes to the distribution of benefits and considers ignored social groups (Jenkins et al. 2016; ILO 2019). These assessments and policy measures can contribute to the achievement of several SDGs. For example skills development can contribute to quality education (SDG 4), gender equality (SDG 5) and job creation (SDG 8) and hence to reduced inequalities (SDG 10)





**Figure 1.** Just energy transition framework (own elaboration based on Jenkins et al. 2016; ILO 2019) .

(Comyn 2018; Núñez et al. 2020). Social protection policies are necessary for recognition-based justice that protect workers and vulnerable groups. Social dialogue is essential in procedural justice and it can ensure a better outcome in recognition-based justice, allowing more voices to be heard and integrated (Jenkins et al. 2016; ILO 2019). Such dialogues encourage participatory and representative decision-making (SDGs 10 and 16) and social protection policies can contribute to reducing poverty and inequality (SDGs 1 and 10) (Plagerson and Ulriksen 2016; Carraro and Marzi 2021). Finally, while transfer of knowledge and technologies to and within countries support recognition-based justice globally and domestically and improve distribution of benefits, local innovation and responsible investments could enhance procedural and distributational justice. The latter measure would encourage local knowledge mobilisation, involvement of the private sector as a stakeholder, creation of jobs and economic activities that distribute more benefits in the country and management of negative impacts through responsible investments (Jenkins et al. 2016; ILO 2019). Such knowledge and technology transfer can contribute to global partnership (SDG 17) (Mago 2017). Notably, all policy measures of a just energy transition contribute to the achievement of the Paris Agreement, through reduced greenhouse gas emissions, and of the 2030 Agenda, through co-benefits (Oei 2018). In itself, a transition away from coal and to renewables can contribute to the achievement of clean energy (SDG 7) and good health (SDG 3), can foster innovation (SDG 9), contribute to sustainable settlements (SDG 11) and responsible consumption and production (SDG 12), can reduce freshwater and marine pollution from, e.g. open mining (SDGs 6 and 14) and halt biodiversity loss (SDG 15) if implemented correctly (Haines et al.



2007; Jagger et al. 2019; Quitzow et al. 2019; Ahmad and Riffat 2020; Franco et al. 2020; Swain and Karimu 2020; Vaidya and Chatterji 2020; Ahirwal and Maiti 2021; Singh et al. 2021). Yet, depending on the context, choice of technology and implementation, apparent synergies can turn into trade-offs, e.g. hydropower projects can result in water scarcity (SDG 6) and biofuel production can hinder food security (SDG 2) (Liu et al. 2015; Alola et al. 2019; Pfister et al. 2020).

Combined as shown above, the concepts of “energy justice” and “just transition” can be used to explore potential impacts and injustices in a green energy transition and how these are or could be addressed. These concepts can help to ensure a fair distribution of costs and benefits, to identify and include actors that were ignored, and to develop new and fair policy processes. Such an approach would support the SDGs and climate goals and ensure compliance with the principles of “inclusiveness” and of “leaving no one behind” enshrined in the 2030 Agenda. In that sense, the just energy transition framework is highly relevant in countries where a coal phase-down or phase-out is envisioned, given the multitude of socio-economic and environmental implications. In the following, we present our research design and methodology for the application of the just energy transition framework in two coal-dependent countries, South Africa and Germany.

### ***Research design and methodology***

This study follows a deductive qualitative method approach to analyse country cases aiming to understand specific objects (Stake 1995; Ragin 2000). The applied research design is a most different systems design following Mill’s (1884) method of similarity, also known as direct method of agreement. Thereby, the cases being compared are different cases, but have in common the dependent variable – the aimed implementation of a just energy transition. The analysis is conducted by applying the just energy transition framework introduced above. The just energy transition framework developed in this study is highly relevant to energy transition in coal producing countries, where impacts are expected to be significant due to the substantial size of the coal industry and related jobs and economic activities. As countries have specific social, economic and environmental conditions, tailored policy mixes that cover industrial, sectoral, social protection, skills, social dialogue and labour policies will be required. This paper analyses current measures and identifies country-specific opportunities and obstacles to a just energy transition that addresses both climate and sustainable development goals. It explores distributional, procedural and recognition concerns in Germany and South Africa, and how current policies and policy processes address the three justice tenets, through applications of the ILO-recommended just transition measures.

The contextual analysis in this study is conducted through detailed assessments of the country cases, Germany and South Africa, to better understand complex context-dependent issues (Yin 1994; Ragin 2000) and the different policy approaches to a just energy transition in each country. To that end, we conduct a content analysis of scientific literature, national policy documents, online news articles and semi-structured interviews (Kohlbacher 2006; Mayring 2015). Our study primarily relies on sustainability and energy-relevant official national policy documents, such as laws, plans, bills and strategies, and international communications such as the Voluntary National Reviews (VNRs) under the 2030 Agenda and NDCs under the Paris Agreement. To cover the latest issues and trends

related to the countries' policies and to include various voices on the issue of energy transition, we also refer to newspaper articles. Moreover, between March and July 2019, we conducted five semi-structured interviews in Germany and four in South Africa to complement our policy and literature analyses and get a better insight into the background processes and policy impacts. To receive diverse opinions, the interviews were conducted with researchers and policy advisors (two in each country), representatives of civil society organizations (two in Germany, one in South Africa), and the private sector including a labour union representative (one in each country). Three out of nine interviewees were female. The interviewees were selected according to their knowledge and experience in the respective countries and fields. In order to ensure reliability and comparability, we sent a list of interview questions (see Supplementary Material) to the interviewees via email in advance (Bernard 2006). The objectives of the interviews were to

- (1) identify pressing challenges and thematic areas in respective countries in implementing climate and sustainable development goals, and with a view to the energy sector,
- (2) identify synergies and trade-offs deriving from institutional arrangements and policies that address the sustainable and energy transition, and
- (3) identify relevant stakeholders on different levels (research, policy, private sector, civil society) that should be included in the processes of a just energy transition.

We chose a small number of interviewees since our study predominately looks at the governance arrangements and policies for a just energy transition through the analysis of policy documents. The interviews served as orientation and identification of key national issues and policies. Importantly, these interviews helped us to better understand the challenges that the two countries face when designing and implementing the just energy transition measures on the ground, and that may not be apparent from a content analysis of the policies themselves.

### ***Rationale for the selection of country case studies***

For the purpose of this study, we selected Germany and South Africa as country case studies. We aimed to analyse countries among the top 20 GHG emitters (that jointly account for 71% of global GHG emissions, excluding EU) (Ritchie and Roser 2019a), with substantial production and consumption of coal (Ritchie and Roser 2019b), but with different capacities to address this issue. In that sense, we looked for countries with dissimilar energy transition readiness (WEF 2019), as well as key socio-economic and political indicators such as income-level, inequality, governance effectiveness, status of democracy and SDG achievement. We assume that the more economically and socially developed and the more democratic a country is, the higher its institutional, political and economic capacities are to implement a just energy transition. Here, we chose to focus on democracies as this regime type is more likely to resort to participatory approaches (needed for procedural justice). Moreover, we wanted to analyse countries that were at relatively different stages in their energy transition away from coal to also gain insights into how certain measures unfolded and what could be learned.

From those perspectives, Germany and South Africa proved to be suitable candidates for our study (see [Table 1](#)). First, the countries have dissimilar economic and socio-political backgrounds, whereby Germany performs better on indicators such as income levels, GINI index, state-capacity and status of democracy (UNU-WIDER [2015](#); BTI [2018](#); WGI [2019](#); World Bank [2019a](#)). In that sense, the SDG Index also shows stark differences in the level of achievement of the 2030 Agenda in the two countries. In implementing the SDGs, Germany is ranked sixth out of 162 countries. The country especially ranks high in areas related to social and economic development, but falls short of achieving SDG 10 (reduced inequalities), and especially the environmental SDGs, such as SDGs 12 (responsible consumption and production) and 13 (climate action) (Sachs et al. [2019](#)). South Africa, on the other hand, ranks 113th out of 162 countries, as eliminating poverty (SDG 1), ensuring food security (SDG 2), reducing inequality (SDG 10), and building an inclusive economy (SDG 8) remain major challenges (Sachs et al. [2019](#)). Second, while both countries have a similar level of coal production (Ritchie and Roser [2019b](#)), South Africa has a much higher share of coal in electricity supply, covering 85% of electricity generation in 2019 (Our world in data [2019](#)). Moreover, as the fifth largest exporter of coal globally, South Africa has a large energy-intensive coal industry which is currently critical to its economy. Importantly, Germany decreased its share of coal in electricity production from 60% in 1990 to 28% in 2019 (Ritchie and Roser [2019b](#)) and more than halved its production of coal in the past 20 years (1999–2019), while South Africa’s coal production slightly increased over the same period (ibid.). For that reason, South Africa is regarded as a “recalcitrant” nation in terms of coal phase-out, facing trade-offs between short-term economic viability and long-term climate security (Svobodova et al. [2020](#)). Germany, on the other hand, is categorized as an “early-stage transition follower” with significant success in increasing the share of renewables in the energy mix (Svobodova et al. [2020](#)). Yet, coal remains a significant energy source in Germany and is currently providing about one-third of electricity generation (Fraunhofer [2020](#)). In that sense, Germany as a case study is expected to provide insights on how a reduction in coal production and consumption was conducted so far, and on how it aims to move ahead in the future. We assume that the higher the dependence and investments in, and relative revenues from fossil fuels, the higher incentives to block transformation towards green energy production and consumption. Third, despite these differences in energy transition advancements to date, both countries are considered to currently have “highly insufficient” commitments to meet the Paris Agreement target of keeping global warming to well-below 2°C temperature increase (CAT [2019](#)). This further shows the need for more stringent climate action and a rapid and drastic transformation of the energy system in the short and medium-term in both countries.

### **III. Results: evidence from Germany and South Africa**

#### ***Evidence from Germany***

In the case of Germany, all of our interviewees referred to the nation-wide decarbonisation and associated energy transition as the most challenging issue area of domestically implementing the 2030 Agenda and the Paris Agreement (Interviewee 1 [2019](#), Interviewee 2 [2019](#), Interviewee 3 [2019](#), Interviewee 4 [2019](#), Interviewee 5 [2019](#)). The COVID-19

**Table 1.** Socio-economic, political, energy-related and climate and SDG-related indices (own elaboration based on UNU-WIDER 2015; BTI 2018; CAT 2019; IEA 2019; Our world in data 2019; Sachs et al. 2019; WEF 2019; WGI 2019; World Bank 2019a, 2019b; Ritchie and Roser 2019b).

Indicator	Germany	South Africa	Global average
<b>Economic, social, political</b>			
Income-level (2019)	High-income	Upper-middle-income	-
GDP growth (annual %) (2019)	0.60	0.20	2.47
GINI (0 = equality, 100 = inequality) (2015)	30.1	60.8	-
Status of democracy (2018)	Consolidated	Defective	-
State capacity (-2.5 = very low, +2.5 = very high) (2019)	1.53 (high)	0.37 (moderate)	-
<b>Energy related</b>			
Energy transition readiness (%) (2019)	64	37	55
Coal production (annual TWh) (2019)	351 (11th globally)	1672 (7th globally)	-
Coal in electricity production (%) (2019)	29	86	37
<b>Implementation of Climate and SDG Agendas</b>			
Climate action (<=1.5°C = role model, 4°C+ = critically insufficient) (2019)	<4°C highly insufficient	<4°C highly insufficient	<3°C (insufficient)
SDG Index (0 = worst, 100 = best) (2019)	81.1 (6 out of 162)	61.5 (113 out of 162)	-

emissions drop helped Germany to meet its 2020 climate target of cutting GHG emissions to 40% below 1990 levels; however, current GHG emissions reduction targets are insufficient (CAT 2021a). In May 2021, the German Climate Change Act was updated following the German Supreme Court ruling of an unfair burden on future generations (hindering SDG 10) if current climate targets and trajectories persist and SDG 13 is not met. The government increased their goals to 65% emission cuts by 2030 and 88% by 2040 while committing to climate neutrality by 2045 (German Federal Government 2021a). However, early research shows that the country would need an emission reduction target of 69% below 1990 levels by 2030 to be in line with the 1.5°C limit (CAT 2021a). Moreover, plans to phase-out coal by 2038 represent a timeline which is highly insufficient to achieve the 1.5°C goal, since it is almost a decade too late (CAT 2020).

Germany's energy transition policy, internationally known as *Energiewende*, aims at decarbonising the energy sector. The country is often referred to as a frontrunner in the transition to renewables. Today, renewable sources produce 38% of electricity in Germany (Svobodova et al. 2020). For the future, the Coal Exit Act and the Climate Action Programme 2030, a supplement of the Climate Action Law, set a target of 65% renewable energy share in gross electricity consumption in 2030 (BMU 2019; BMWi 2020b). However, stringent policy measures to achieve this share are so far missing and it remains unclear how Germany will achieve this self-imposed goal and at the expense of whom (CAT 2020). In December 2020, Germany submitted its updated NDC jointly with all EU member states. This joint EU NDC explicitly mentions the Just Transition Fund, which aims at supporting workers and communities that rely on the fossil fuel value chain and alleviate socio-economic impacts, thereby contributing to the 2030 Agenda's core principle "leaving no one behind" and SDGs 1 and 10 (European Commission 2020, 2021; European Union 2020). On the one hand, Germany's reliance on coal in particular creates trade-offs with climate change mitigation and environmental protection, especially along the WEF nexus (SDGs 2, 6, 7 and 15) (German Federal Government 2016). Yet, the transition to renewables also comes along with some environmental trade-offs. For instance, wind turbines' effects on species conservation and local fauna have led to citizens resistance (SDGs 7 and 15) (Wehrmann 2019). On the other hand, two interviewees mentioned that the phase-out of coal can have negative socio-economic implications for coal regions (SDGs 1, 8 and 10) (Interviewee 1 2019, Interviewee 2 2019). In the following sections, we will apply our framework of a just energy transition to the case of Germany. We aim to evaluate how the tenets of justice are addressed, how the just energy transition commitments are integrated into national policy, what gaps remain and where the biggest challenges reside for a just energy transition.

### **Distributional justice**

The energy transition in Germany has so far been faced with a series of challenges in addressing resulting distributional injustice. While phasing-out coal, Germany has been slowly increasing its renewable energy sector. To level the playing field, Germany introduced feed-in tariffs (FITs) through the Renewable Energy Sources Act that guaranteed appropriate pricing and priority access for renewable energy producers (German Federal Government 2021b). However, the resulting costs are transmitted to the electricity consumer, which results in a financial burden on lower income

communities and creates trade-offs with regard to SDGs 1 and 10. Moreover, when managing the renewables inventory, large developers are preferred, which raises questions on the inclusiveness and competitiveness of the system (SDGs 8 and 9) (Svobodova et al. 2020). Importantly, due to increased usage of land for renewables, farmers are complaining about higher prices for agricultural land, which poses a risk to food security and may lead to social injustices (SDGs 2 and 10) (Müller 2017). Moreover, research shows that increased biofuel production from rapeseeds enhances the competition for freshwater resources and pastureland, and when produced as large-scale monocultures, can affect biodiversity (SDGs 2 and 6) (Gerbens-Leenes and Hoekstra 2011; Rulli et al. 2016).

To address some of these challenges, several measures were taken in Germany to improve distributional justice of the coal phase-out. To address the issue of overburdening electricity prices, the Coal Exit Act, adopted in July 2020, includes an authorization to compensate electricity consumers in the event of a coal phase-out related increase in electricity prices, which is a social protection measure that simultaneously benefits SDGs 1 and 10 (BMW 2020a). Moreover, FiTs were later offered to a variety of contributors to the Energiewende, such as citizens, farmers and cooperatives, which now jointly own 40% of the country's renewables, thereby contributing to distributional justice and mitigating local resistance to renewables (SDGs 1, 7 and 8) (Svobodova et al. 2020). To enhance acceptance, Germany's government has recently agreed on a distance regulation of 1000 metres between wind turbines and settlements to avoid noise pollution (SDGs 3 and 11), but the federal states can now actively decide for or against the application of this rule (Schulz 2020). This would decrease the available space for wind turbines and could jeopardise the government's plan to substantially increase the share of renewables in view of SDG 7 (German Federal Environment Agency 2020). Beyond these measures, individual financial compensation for citizens affected by the installation of a wind turbine in their neighbourhood was found to be effective (Wehrmann 2019). Furthermore, some solutions were suggested to solve the "green-green dilemma" of expanding renewables while simultaneously protecting biodiversity, water resources and agricultural land for all (SDGs 2, 6, 15). For instance, the German Nature and Biodiversity Conservation Union (NABU) suggests banning the construction of renewables in ecologically sensitive areas, which could benefit SDGs 6 and 15 (NABU 2016). However, so far no clear regulation was adopted on this matter.

Importantly, to ensure an adequate distribution of the benefits and ills of the energy transition, the German government needs to assess and address socio-economic impacts, such as loss of economic activities, unemployment and green jobs potential, as indicated in our framework (ILO 2019). The coal phase-out will cause job losses and hinder SDG 8. Solely in the employment sector of lignite mining and power plants, hard coal power plants and hard coal mining, 80.000 jobs in mostly rural regions are affected. Moreover, many more jobs which are linked to heat and power generation will also be affected (Moch 2019). Around 19.800 workers are directly affected by the coal phase-out; 8.300 in Lusatia, 9.000 in the Rhine region, 2.400 in central Germany and 200 in the Helmstedt area (WSB 2019). To put this in context, these numbers represent just under 1% of the total number of employees in these regions. Moreover, two thirds of these employees will be older than 60 in 2030 and will retire or be close to retirement, which significantly lowers the number of directly affected employees by the coal phase-out. The Coal Exit Act

includes an adjustment allowance and early retirement for older employees in the coal sector (BMW 2020a) thereby contributing to distributional and recognition justice by recognizing the elderly and providing social protection. Moreover, new employment opportunities will emerge in the renewable energy sector and are estimated at 338.500 jobs (Wörten et al. 2017; Analytics 2018). Nevertheless, green jobs potential, especially in the renewable energy sector, remains uncertain as past developments have shown, e.g. after the end of the solar boom in 2012, that renewables installation rates have fallen in recent years, leading to 100.000 lost jobs (BMW 2018). Even though concrete measures, such as occupational retraining and skill acquisition for coal workers are explicitly mentioned in the Growth, Structural Change and Employment Commission's final report, as well as in the final report on the coal exit of the Federal Environment Agency and other policy documents, concrete policies to implement these trainings are not yet in place (Wörten et al. 2017; Analytics 2018; Oei et al. 2019; WSB 2019).

Germany set aside financial support to tackle these socio-economic challenges. Through the Investment Act for coal regions (German Federal Government 2020), the federal government has committed itself to providing up to €26 billion by 2038 to strengthen economic growth and create jobs in the lignite regions. Moreover, the Structural Aid Act associated with the Coal Exit Act earmarked additional €14 billion to support coal regions (Wassermann et al. 2015; Roberts et al. 2020; BMW 2020b). This financial support primarily intends to facilitate structural change and implement regional development plans, to compensate for the loss of jobs and to enable developments towards a sustainable economy through infrastructure expansion and new research facilities in affected regions, contributing to SDGs 4, 8 and 9. Besides, federal states of affected coal-mining regions are allowed to use the financial support to invest in business-related infrastructure, public transport, environmental protection and landscape conservation, which benefits SDGs 9, 11 and 15 (BMW 2020b). Other financial measures will be secured through the EU's Just Transition Fund, of which Germany will receive the second largest funding slice after Poland. Thus, Germany will have financial means to facilitate new employment opportunities, offering re-skilling trainings, investing in clean energy, and rehabilitating former coal-mining areas, thereby contributing to SDGs 7, 8 and 15 (European Commission 2020; Morgan 2020). Finally, the German government is compensating coal companies with an additional €4.35 billion. However, early research shows that the government is overcompensating these companies by almost €2 billion, questioning the equal distribution of benefits and ills of the energy transition and pointing to potential trade-offs with regard to SDGs 1 and 10 (Matthes et al. 2020).

Despite aforementioned trade-offs, the coal phase-out offers multiple benefits. With regard to health, the coal phase-out would avoid air pollution from coal power plants and remove unsafe mining jobs, substantially benefitting SDG 3 (Analytics 2018). In 2015, air pollution from German coal power plants was responsible for 3.850 premature deaths, 1.800 cases of adult chronic bronchitis, 79.000 asthma attacks of children and 1.2 million working days lost, and related estimated costs of €5.5–10.5 billion (Europe Beyond Coal 2017). Such effects were also caused across German borders, as Germany possesses six of the most polluting coal plants in Europe (ibid.). Moreover, one interviewee mentioned that a fast coal phase-out would avoid further relocation of towns and forest clearing for new lignite mining (Interviewee 4 2019). To date, 120.000 people



were relocated due to mining (WSB 2019). In contrast, a transformation of closed mining areas into recreational areas, lakes, and touristic attractions could increase quality of life and provide new income sources for the local population (Analytics 2018). Thus, a just energy transition could benefit good health (SDG 3) and economic growth (SDG 8), decrease inequality (SDG 11) as well as ensure forest conservation (SDG 15). A disregard of the societal benefits emerging from the coal phase-out and how these could be enhanced and justly distributed, has kept policy makers from developing long-term plans to meet the transition objectives advocated by citizens in a socially acceptable manner (Svobodova et al. 2020).

### ***Recognition justice***

Among others, addressing the tenet of recognition justice requires skills development, job transition support and social protection policies for workers and vulnerable groups (ILO 2019). As mentioned above, the Coal Exit Act, Structural Aid Act and the Just Transition Fund recognize the challenges of various groups in mining regions and provide financial, technological and planning support to ensure a positive future in these regions (BMWi 2020b). The adjustment allowance and early retirement for older employees in the coal sector (BMWi 2020a) serve as social protection measures for the vulnerable group of elderly (SDGs 8 and 10). Moreover, a package for the protection of employees has been developed. It includes compensation of lost wages and pension's deductions, qualification programmes, placement of the employees in new work sectors, participation in trade unions and workers' councils, collective bargaining agreements, and no business-related layoffs in mining and power plants (SDGs 4, 8, 16). In cooperation with social partners, structural change is actively shaped to create high-quality jobs in mining regions and hard coal locations (WSB 2019). Yet, as mentioned above, concrete policies for occupational retraining are so far lacking. One interviewee stated that the principle of "leaving no one behind" to date remains ignored in Germany and points to a widening gap between rich and poor (Interviewee 1 2019). These lacking policies could create trade-offs with SDGs 1, 8 and 10.

In early 2019, the "Growth, Structural Change and Employment Commission", also known as the Coal Commission, which was appointed by the government to represent multiple stakeholders, found a compromise for phasing out coal-fired power generation. The Commission was established to avoid structural discontinuities in the affected regions and to develop a regional and industrial policy strategy that shapes structural change and supports new businesses and their workforce to adapt to the new regional structures (WSB 2019). This multi-stakeholder commission involved 31 stakeholders from trade unions, politics, environmental associations, industry, and affected federal states, aiming to recognize all stakeholders affected by the coal phase-out (GSDS 2018). However, one interviewee indicated a general concern that some stakeholders were left behind in the German energy transition (Interviewee 2 2019). This holds true for the vulnerable group of youth that is not represented in the Coal Commission, although they will be most affected by climate change and the energy transition. Farmers were not represented either, although they will be significantly affected by increasing land prices due to the expansion of renewables. Women are also underrepresented, covering only 10 out of 31 membership positions in the Coal Commission (Kern and Meier 2018) potentially

generating trade-offs with SDGs 5 and 10. Moreover, the Commission fails to include local knowledge and stories, as well as place and cultural identity that are essential to guarantee recognition justice (Jenkins et al. 2016). Two interviewees further highlighted the government's failure to integrate climate targets into the German Sustainable Development Strategy (Interviewee 1 2019, Interviewee 3 2019), pointing out the lack of recognition of future generations and how they will be affected by climate change.

Important gaps in fully acknowledging and including unrecognized and marginalized social groups and in listening to their needs, stories and knowledge still exist. Moreover, using the available funds in the different regions effectively to achieve social stability and to create economic perspectives for a broad range of social groups is expected to be difficult due to diverse needs and demands (Reitzenstein and Popp 2019).

### ***Procedural justice***

The Coal Commission aimed to enhance procedural justice through a social dialogue bringing together representatives from all sectors. According to one interviewee, the establishment of the commission would not have been possible without strong support by Chancellor Merkel and political as well as public pressure, pointing at the heightened need for inclusive processes (Interviewee 2 2019). Given the challenges of the coal phase-out and the multiple interests at the table, the Coal Commission required long negotiations, but an agreement to gradually phase out coal by 2038, with the option of pushing this deadline to 2035, was reached. The achieved compromise received broad societal consensus, suggesting a perceived legitimacy of the Commission as an inclusive body (Reitzenstein and Popp 2019).

Nevertheless, although the Coal Commission aimed to represent affected regional stakeholders through representatives, it remains limited in its inclusiveness and decision power. Participation in decision-making does not only mean physical involvement. For instance, the consideration and representation of knowledge and stories of local communities through active listening and early engagement of local communities is essential to procedural justice (Jenkins et al. 2016). One interviewee compared the coal phase-out in affected regions to a colonialization process and questioned a democratic and just energy transition (Interviewee 4 2019). Another interviewee pointed to intergenerational justice, which has so far not been taken into account by the German government (Interviewee 1 2019). Thus, in order to achieve structural change, acceptance by the local community needs to be ensured, along with the development of new economic activities. One interviewee suggested institutionalizing a local dialogue through associated resident councils in the affected regions, with support from the central government (Interviewee 1 2019). Moreover, the coal exit roadmap of the Coal Commission was significantly watered down by the government from the original multi-stakeholder compromise. Especially the schedule of a gradual phase-out from 2023 onwards now concentrates on the period between 2028 and 2029. The amendments were met with criticism by members of the Coal Commission, environmental associations and scientists since they are not in line with the Paris Agreement and create trade-offs with SDG 13 (Oei et al. 2020; Praetorius et al. 2020).

Through increased knowledge and technology transfer to the global South, Germany aims to fulfil its international responsibilities in solving global challenges, such as the energy transition, and contributing to SDG 17. The German government wants to strengthen the positive international perception of the Energiewende through bilateral cooperation and partnerships with strategically important partner countries. For instance, Germany is a member of the Powering Past Coal Alliance (PPCA) aiming to advance the global coal phase-out and a just energy transition as mentioned in the country's VNR (German Federal Government 2021c). Moreover, it responded to South Africa's call for support and joined the Just Energy Transition Partnership initiated at COP26 (COP26 2021). Knowledge creation through high-level intergovernmental dialogues on energy policy that address concrete challenges and serve as international exchange of experience are furthermore envisioned. Overall, Germany has a special responsibility in implementing the energy transition given its high historical GHG emissions and the high share of coal. Yet, the country has failed to inform citizens on changing energy consumption behaviour needs and opportunities and did not provide information on new energy saving technologies (Müller 2017), leaving another important gap in procedural justice.

### ***Summary of findings***

To conclude, although Germany has made progress in defining and implementing drivers and means to phase-out coal by taking into account the tenets of justice, concrete policies to implement these drivers and means are so far insufficient. On the one hand, the Coal Commission's multiple-stakeholders approach represents an inclusive form of governance in line with procedural justice. Additionally, compensation schemes and social protection measures are in line with distributional and recognition justice. On the other hand, bottom-up processes in the affected regions including local knowledge mobilization and full information disclosure, to create ownership and to develop a clear idea of what comes after coal, are so far lacking. Concrete policies for occupational retraining are not yet in place either. Moreover, Germany has so far failed to develop adequate measures for all off-track national SDG indicators, creating further limitations for implementing a just transition in line with the Paris Agreement and the 2030 Agenda (Clark et al. 2018; GSDS 2018; Appun and Wettengel 2019).

### ***Evidence from South Africa***

All South African interviewees stated that the coal phase-out and associated trade-offs along the WEF nexus and on the triple challenge of eliminating inequality, poverty and unemployment are the biggest concerns when implementing the 2030 Agenda and the Paris Agreement (Interviewee 6 2019, Interviewee 7 2019, Interviewee 8 2019, Interviewee 9 2019). A just transition has been referred to as a synergic solution in the country's NDCs, Voluntary National Review (VNR) and National Development Plan (NDP), as well as in conducted interviews (South African Government 2012, 2019, 2021a, 2021b). More than 86% of electricity generation in South Africa stems from coal and the country remains one of the major coal exporters, making it highly reliant on coal. So far, only one coal plant was shut down, 41 are still operating and five are under construction (Roberts et al. 2020). Due to the COVID-19 pandemic and associated decreased mining activities, South Africa's emissions are currently decreasing. Thus, the country overachieves the upper range of its

NDC target. However, South Africa's climate commitment in 2030 is not consistent with the Paris Agreement's target of keeping global warming below 2°C and remains highly insufficient (CAT 2020). In September 2021, South Africa set a stronger target to 2030 in its updated NDC (South African Government 2021b), but the new target is still not in line with the Paris Agreement (CAT 2021b).

Next to the country's high reliance on coal and insufficient climate policies, the elimination of poverty (SDG 1), inequality (SDG 10), and unemployment (SDG 8) represent fundamental challenges that may undermine climate objectives and create trade-offs with SDG 13. Moreover, the COVID-19-related slowdown of domestic economic activity has led to an economic downturn of -7% of GDP in 2020 (World Bank 2020), further burdening the country's triple challenge, but a recovery of 3.7% of GDP is estimated in 2021 (SARB 2020). First proposals by the South African government for post-pandemic recovery, such as a "Mining and Energy Recovery Plan" which includes development of new coalfields, indicate a prioritisation of carbon-intensive investments over a "green" economic recovery. This will jeopardise the achievement of multiple SDGs and some of South Africa's own policies (SA News 2020a). For instance, a carbon-intensive recovery would jeopardise the implementation of the Integrated Resource Plan (IRP). The IRP's update in 2019 marks a shift in energy policy towards renewables and aims to shut down over 35 GW (of 42 GW currently operating) coal generation capacity by 2050 (Department of Energy 2019; CAT 2020). Importantly, the COVID-19 pandemic recent social unrest and looting in July 2021 have exacerbated the country's health, as well as social and economic challenges that could slow down South Africa's coal phase-out and the implementation of related SDGs, such as SDGs 1, 3, 7, 8 and 10 (CAT 2020; Nebe 2021). In the following sections, we will apply our just energy transition framework to the case of South Africa to assess the country's progress and challenges in implementing the energy transition.

### ***Distributional justice***

To increase renewable energy investments and diversify the country's energy mix, South Africa launched the Renewable Energy Independent Power Producer Procurement Programme (REI4P) in 2011, replacing FiTs. The REI4P aims to generate 20,000 MW of renewable energy by 2030 by signing up to currently 27 Independent Power Producers, which have a mitigation potential of 8.1 Megaton CO<sub>2</sub> equivalent per annum (South African Government 2019) significantly contributing to the achievement of SDGs 7 and climate goals. Thereby, the REI4P's targets are set in line with the IRP (Cape and van der Westhuizen 2015). Simultaneously, the REI4P aims to boost local economic development through renewable energy projects income and ownership of wind and solar farms (SDG 8). Thereby, REI4P requires a diversion of revenue of up to 20% to local communities, hence contributing to distributional justice (Independent Power Producers Office 2019). The REI4P procured 6.4 GW of renewable projects by June 2019 (Independent Power Producers Office 2019).

Nevertheless, one interviewee argued that the benefits of REI4P projects are not equally distributed (Interviewee 7 2019) pointing to trade-offs with SDG 10. The balance of power between the renewable energy companies and communities is unequal and only limited socio-economic benefits are associated with REI4P. Especially job creation

through REI4P is rather limited, as most created jobs are only short-term, for construction work, whereas long-term manufacturing jobs are located in urban centres and not in affected rural regions hampering SDGs 8 and 10 (McDaid 2016). Moreover, municipalities are facing declining revenues and secondary economic effects on the local economy will emerge (Strambo et al. 2019). The coal-mining sector currently employs 82.000 workers. Projections show that jobs in the sector will shrink to around 21.000 by 2045. Early retirement will not be an option, since most workers are aged under 40 (ibid.). Alternative sectors for job creation in the region are renewable energy, IT, agriculture, rehabilitation, and manufacturing, but such a transition requires training and job change support (ibid.). While phasing-out coal is often associated with job losses, regional economic development and other related consequences of moving away from coal are not addressed. In addition, affordability and access to renewable energy systems remains a concern, which is exacerbated through increasing informal settlements in urban areas constituting trade-offs between SDG 7 and 11 (South African Government 2019). Although an interviewee highlighted the particularly high progress on electricity access from only around 50% of the population in the 1990s to above 80% to date, reaching remaining population in isolated areas while also maintaining electricity prices low remains a challenge for the energy transition (Interviewee 8 2019). The uptake of off-grid solar systems remains very low, with only 1% of the population utilizing these technologies.

To boost the electricity reach and the uptake of renewables, policy measures that address social, economic and environmental trade-offs and enhance co-benefits were developed. A spatial planning for wind and solar energy developments in the country, taking into account environmental, social, and economic factors, was sought through a strategic environmental assessment by the Department of Environmental Affairs (DEA). Hereby areas with high economic potential and high social need were identified as priority areas for renewable energy manufacturing. An environmental and technical constraints mask was further developed to eliminate areas with highly sensitive features, such as protected areas. Afterwards, the identified areas were consulted with provincial governments and the private sector to guide the development of wind and solar energy in an economically, environmentally and socially just way (South African Government 2019) and in line with the tenets of distributional and recognition justice. In addition, these assessments contribute to the achievement of SDGs 7, 10 and 15. According to one interviewee, trade-offs between food security and renewable energy have not been evident (Interviewee 7 2019). In fact, landowners tend to benefit from having solar panels on their land and at times, combine these with other productive uses, such as raising sheep, which also protect the solar panels from grass growth pointing to synergies of SDGs 2, 7 and 15. This stands in stark contrast with the country's current coal mining activities that pollute surface- and groundwater with acid and metals, making agricultural land unproductive and leading to trade-offs with SDGs 2, 6 and 15 (Shawoo et al. 2020).

Nonetheless, green job creation, transferable and high skills development such as electrical and mechanical knowledge, and upgrading measures to enable transitions in labour markets are insufficiently developed and conflict with SDGs 4 and 8. As mentioned-above, green job creation through REI4P remains limited. This also applies to the carbon tax adopted in 2019. Environmental campaigners and industries criticize the tax due to its weakness and potential job losses in the mining and automobile sector (Climate Home

News 2019). Moreover, the tax level itself is too low at the moment and should increase over time, according to one interviewee (Interviewee 8 2019). Due to the government's current post-pandemic recovery proposals and measures, low-carbon economic recovery and green job creation remain further limited, although recent research shows that investments in renewables present the cost-optimal energy supply choice (Roff et al. 2020).

### **Recognition justice**

Barriers to renewables are tied to marginalization, corruption, poverty, and ongoing investments in fossil-fuel-driven companies, affecting the achievement of SDGs 1 and 10 (South African Government 2019). The state-owned electricity utility, Eskom is still reluctant to phase-out coal and invest in renewables (McDaid 2016). It is further interested in aligning its economic interests with the status quo (Montmasson-Clair 2017). To date, Eskom and Sasol, the largest coal-to-chemicals producer, jointly account for more than 50% of the country's greenhouse gas emissions and 85% of coal used in the local market by volume (Mailula 2019). The coal phase-out is a politically salient issue. Eskom's financial solvency contributes to the country's planning uncertainty, delays the extension of renewable energy systems and jeopardises the IRP and REI4P implementation. In October 2019, the government increased financial support for Eskom's bailouts, increasing the pressure on the national budget (Cohen 2019; CAT 2020). Thus, Eskom remains a central and powerful actor, thereby slowing down a just energy transition process. These vested interests hinder the implementation of the SDGs and climate goals. One interviewee said that the implementation of the international agendas can only be understood if the state's corruption of past years is taken into account. The interviewee specifically referred to "[...] forms of political entrepreneurship that undermine state capacity and ability by redirecting funds for corrupt purposes as depleted resources in the state" (Interviewee 6 2019).

Special recognition is needed in vulnerable mining regions, in particular in Mpumalanga, where the coal mining industry in South Africa is concentrated and 80% of the coal production occurs. Local social and economic effects of the coal phase-out will likely be significant in this region. Job losses will emerge in power stations, coal mines and transport, conflicting with SDG 8. This "could potentially trigger social destabilization" (Strambo et al. 2019, p.12). One interviewee pointed to the importance of distinguishing between relative and absolute inequality. The interviewee further argued that South Africa has to deal with "absolute inequality because the divide between rich and poor is growing" (Interviewee 6 2019). Therefore, risks and vulnerabilities of affected people, especially in Mpumalanga need further analysis, and regional development plans and governmental interventions must be developed. An interviewee stated that the current focus of the affected people lies on job security rather than on environmental concerns or regional development:

"there are whole communities built around coal, that live around a coal-fired power station, and pretty much everyone works there and all livelihoods depend on that. Hence, what happens to those individual families and communities and people is a separate question from [...] a net national benefit of employment gain if that doesn't help them look after their family and community" (Interviewee 8 2019).



In line with the tenet of recognition justice, social protection policies to protect workers and vulnerable stakeholders, such as low-income communities, youth and small business owners, need to be set up, which would also turn into synergies with SDGs 1 and 10. Plans and initiatives, such as the REI4P and the strategic environmental assessment by the DEA, should be further enhanced and improved in order to deliver to multiple SDGs, while further mitigating emissions. Especially green job creation and skills training (SDG 8), local ownership of renewable energy systems (SDG 10) and biodiversity protection (SDG 15) could be achieved by simultaneously ensuring access to sustainable energy (SDG 7). South African researchers therefore suggest setting up a multi-stakeholder task team by the government to review the REI4P implementation model to improve the current consequences faced by affected communities and regions (McDaid 2016).

Besides South Africa's high dependence on coal, the country is confronted with the triple challenge of poverty, unemployment and inequality hampering a just energy transition and the achievement of SDGs 1, 8 and 10. South Africa currently displays features of a low-growth, middle-income trap such as high unemployment rates and low savings (South African Government 2012). High national unemployment rates of 27.25% and up to 80% in some regions are especially among the youth (South African Government 2019). Both high unemployment and discrimination on the basis of age, sex, disability, race, ethnicity, origin, religion, economic or other aspects are prevalent in South Africa and lead to increasing multidimensional poverty and associated challenges (South African Government 2019). Under these conditions, the 2010 New Growth Plan's target to reduce the unemployment rate from 25% to 15% and to create 300.000 jobs in the green economy until 2030, seems rather unfeasible (South African Government 2010; Rennkamp 2012). Moreover, the coal industry has been a sector for job supply to black people in South Africa. "It is a sector dominated by big multinationals, largely white [...] but since 1994 the government has had a program for broadening the economic base [...] to encourage black entrepreneurs to get into greater numbers in the mining sector", as one interviewee explained (Interviewee 6 2019). Thus, young and black people represent particularly vulnerable groups that must be better recognized in the just energy transition process and could synergize with SDG 10.

On a positive note, several measures are taken to increase green-jobs opportunities (SDG 8). The one million climate jobs initiative (OMCJ) of the Alternative Information and Development Center (AIDC) tries to reduce poverty (SDG 1), grow economic sectors that support sustainable development and address climate change (SDG 13). It aims at developing a model of renewable energy roll out that would create 150.000 sustainable jobs in the green energy sector, as well as green jobs in agriculture, green building refurbishment, and alien vegetation cleaning (McDaid 2016). Still, a wider economic and employment development in South Africa's coal-mining regions is needed, such as occupational retraining and skill acquisition that would also benefit SDGs 4 and 8, as well as investments in biofuels production. The government also needs to take into account that especially youth are affected by unemployment. Large parts of these population groups will migrate to urban areas rather than staying in rural regions. Therefore, investments in green job creation in cities are necessary, as one interviewee stated (Interviewee 6 2019). The government therefore promotes a just energy transition through the National Employment Vulnerability Assessment (NEVA) and Sector Job Resilience Plans (SJRPs). NEVA will assess the impact on jobs of climate change to



identify what and where job-related interventions are required. SJRPs will explore sectoral job creation opportunities conducted by the ministries (Strambo et al. 2019). These assessments are in line with distributional and recognition justice while significantly contributing to SDG 8.

### ***Procedural justice***

To ensure a just energy transition, the National Planning Commission has set up a Stakeholder Dialogue on Pathways for a Just Transition, which seeks to build a shared vision between the government, labour, civil society, and businesses taking into account a social dialogue in line with our framework. One interviewee reported that participatory consulting processes within these stakeholder dialogues across the country have been a major success:

“They’ve held workshops in many parts of the country, they’ve particularly reached out to bring in more community based organisations, as well as Labour Unions [...] but the ones that have been the most absent have been the Labour Unions, and they’re particularly important of course in the just transition” (Interviewee 8 2019).

However, the protection of jobs in the mining sector is strongly supported by members of the African National Congress (ANC) due to a strong historical bond between ANC, labour unions, and the communist party. These factors make it even harder to implement a just energy transition. Yet, the Stakeholder Dialogue mobilized local knowledge, managed an early engagement with local communities, youth, businesses and experts and forged strong social consensus, which is essential regarding procedural justice. After seven workshops in different coal-mining regions, they proposed a strategic approach and prioritised the WEF nexus at the core of the just energy transition (NPC 2019), thereby synergizing with SDGs 2, 6 and 7. Although the Dialogue represents a key effort to design a just energy transition, it is not yet sure how such a “social dialogue will inform the implementation of a broad socio-economic development pathway” (Strambo et al. 2019, p.9). The updated NDC of South Africa states that based on the National Planning Commission’s Stakeholder Dialogue, a Just Transition Plan will be finalized (South African Government 2021b). To date, it remains unclear how this will play out in practice and if such a plan will include the tenets of justice.

While coordination issues have been prevalent, South Africa has been particularly successful in setting-up participatory approaches to policy development, involving a wide variety of stakeholders. As noted by one of the interviewees,

“in South Africa, we’ve got a political culture that [...] government obviously makes policy, but it’s quite consultative, it’s fairly participatory, so there are discussions between government, business and civil society and it is fairly standard that big policy questions are consulted on” (Interviewee 8 2019).

For instance, in addition to local and provincial governments, the National Coordination Mechanism is composed of the recently established National Sustainable Development Stakeholders Forum for non-state stakeholders, and a newly set up inter-ministerial Committee on Sustainable Development Agendas that incorporates the Director’s General National Steering Committee including the

Inter-Departmental Implementation Committee and the Inter-Departmental Working Groups (South African Government 2019). Similarly, the National Climate Change Committee promotes cross-sectoral and vertical coordination by including civil society, the private sector, and labour representatives (Petrie et al. 2018). In December 2020, the Presidential Climate Change Coordinating Commission (PCCCC) was established. In the country's updated NDC, the PCCCC is tasked "to oversee South Africa's just transition" (South African Government 2021a, p. 4). It is chaired by the President and is therefore expected to have more influence than the Ministry of Forestry, Fisheries and Environment in coordinating and overseeing the transition towards a low-carbon economy. The PCCCC comprises representatives from government, labour, civil society, business, academia, and traditional leaderships, and will engage with key stakeholders on NEVA and SJRPs to ensure procedural justice (Creamer 2020; SA News 2020b). These engagements can contribute to the achievement of the Paris Agreement's goal, as well as to SDGs 7, 8, 13 and 16. Nevertheless, the country is still lagging behind in implementing its climate and sustainability goals due to a lack of coherence between national, provincial, and local level actions and a mismatch of various planning frameworks across these levels and across sectors.

The private sector also contributes to the implementation of climate policies and the just energy transition. For instance, the South African government together with the National Business Initiative hosted a dialogue series to present their efforts, lessons learnt and knowledge in adapting to and mitigating climate change. Thereby, the African Alliance on the Circular Economy by South Africa, Rwanda and Nigeria was launched (South African Government 2019), which further enhances national and even transboundary knowledge creation in the field of sustainable development. Such alliances contribute to ILO's commitment of increased technology and knowledge transfer and SDG 17.

### ***Summary of findings***

To conclude, South Africa is currently at an early stage of implementing a just energy transition. Given its high reliance on coal and its triple challenge of eliminating poverty, inequality and unemployment, the country has made notable progress considering the tenets of justice. South Africa is slowly moving away from coal to renewable energy, especially through the successful implementation of REI4P and the Stakeholder Dialogue on Pathways for a Just Transition, which are in line with distributional and procedural justice. However, due to central powerful actors, such as Eskom and a strong coal lobby, as well as limited financial means to implement a just energy transition, the dominant political mind-set is only shifting slowly.

### ***Comparison***

As the previous sections have shown, a just energy transition comes with high costs and capacity requirements. Countries aiming for a coal phase-out need to assess associated economic, social and employment impacts and distribute the benefits and ills of such a transition in an equitable manner. Moreover, a just energy transition process must follow a just procedure that ensures inclusiveness, and offer recognition to all affected

social groups. Having analysed Germany's and South Africa's current approaches of planning and implementing a just energy transition; we compare these approaches according to our framework by taking into account the countries' different political, social and economic conditions (see [Table 2](#) and further elaboration in the sections below).

### **Distributional justice**

Germany, as a high-income country with a consolidated democracy and high state capacity can afford compensation schemes for affected regions, enterprises and individuals. Conversely, South Africa cannot afford such measures. In the country's updated NDC, the South African government asks the international community for (financial) support to implement a just transition (South African Government 2021b), which shows the country's socio-economic difficulties. One option for South Africa could be to use revenue from the carbon tax to compensate most affected vulnerable groups, but that is likely highly insufficient both to achieve the climate goals and to support further development, given the current low price (Interviewee 8 2019). In Germany, FiTs have constituted a successful instrument to increase investments in renewables. Yet, the resulting costs are transmitted to the electricity consumer, resulting in social inequalities, although an added provision allows for compensation requests. Similarly, South Africa's REI4P represents a successful approach to boost the expansion of wind and solar farms. However, the benefits of REI4P projects are not equally distributed and the increase of ownership through the diversion of revenue to local communities remained limited. Employment, social and economic impact assessments were conducted in both countries. South Africa's spatial planning analysis for renewables manufacturing and energy production as well as job impact assessments contributed to distributional and recognition justice by taking into account economic potential, social needs and protected ecological

**Table 2.** Comparison of Germany's and South Africa's just energy transition measures and challenges according to our just energy transition framework.

Framework	Germany	South Africa
<b>Distributional Justice</b>	↑ Compensations	↑ Spatial planning by DEA
Assessing employment, social and economic impacts	↓ Increased burden of electricity cost on consumers not addressed	↓ Local jobs and economic losses → REI4P
Potential synergies and trade-offs with SDGs 1, 4, 5, 7, 8, 10, 13, 15	→ FiTs	
<b>Recognition Justice</b>	↑ Adjustment allowance, early retirement	↑ OMCJ, NEVA and SJRPs
Transitions in labour	↓ Vulnerable group of youth not recognized	↓ Missing social protection policies; vulnerable groups (youth and black people) not recognized; no regional development plans
Social protection	→ Regional development plans	→ Green job creation limited
Potential synergies and trade-offs with SDGs 1, 7, 8, 10, 13, 15		
<b>Procedural Justice</b>	↑ Coal Commission; international exchange on energy transition	↑ Stakeholder Dialogue; institutional representation; local knowledge mobilization; transboundary exchange
Social dialogue	↓ No local knowledge mobilisation	↓ Limited representation of labour unions
Technology & Knowledge	→ Information disclosure and institutional representation need improvement	→ Insufficient policy coordination between local, provincial and national levels
Potential synergies and trade-offs with SDGs 7, 9, 10, 13, 16, 17		

Here, we represent measures that were taken in line with our framework with "↑", key remaining unaddressed issues with "↓", and measures that showed mixed results with "→" (own elaboration).

areas. Yet, so far, there are no concrete measures in place to respond to economic losses and the limited local jobs creation in affected regions. Germany's Coal Exit Act includes socio-economic assessments; however, concrete measures for occupational retraining are still lacking.

### ***Recognition justice***

Due to Germany's socio-economic situation and financial means, social protections policies, such as adjustment allowance for employees close to retirement could be implemented. On the contrary, in South Africa, early retirement will not be an option, since most workers are aged under 40. The country's transition in labour is strengthened through the initiatives of OMCJ, NEVA and SJRPs. Yet, green jobs creation through REI4P remain limited and benefits are disproportionately distributed to the private sector rather than communities. Importantly, social protection policies and compensation schemes are so far lacking, which can be explained by South Africa's moderate state capacity caused by corruption and a defective democracy, featuring a dominant political party with strong historical bonds to trade unions. Likewise, any potential job losses are a politically sensitive topic given the high rates of poverty and unemployment. In Germany, regional development plans are mentioned in several policy documents, but concrete measures on how to implement these plans are not yet in place, whereas in South Africa regional development plans are still under development. In both countries, specific vulnerable groups are not recognized. In Germany, youth, farmers and women are not recognized or underrepresented in just energy transition dialogues, while young and black people in South Africa represent particularly vulnerable groups that must be better recognized.

### ***Procedural justice***

The Coal Commission of Germany has been an example of procedural justice in decision-making, also helping to soften negative economic impacts from a distributive justice perspective. However, the Coal Commission failed to include local knowledge and perspectives of youth, thereby still remaining limited in its coverage of interest groups and fulfilment of recognition justice. Politically, inclusiveness and resulting lengthy debates have led to a delayed phase-out of coal to 2038, demonstrating the challenges of procedural justice to generate the needed rapid transformation and ambitious climate action, even under strong financial support and planning. Despite the limited representation of labour unions in social dialogues, South Africa's stakeholder dialogue on the just energy transition was a major success through local knowledge mobilization and conducted workshops in many parts of the country. Germany could learn from these participatory local stakeholder consultation workshops and local knowledge mobilization as well as information disclosure in affected regions. Conversely, South Africa might learn from Germany's federal states policy coordination between local, provincial and national levels (Clark et al. 2018) that remains a challenge for South Africa. Both countries contributed to knowledge and technology exchange in line with procedural justice, such as South Africa's transboundary exchange with Rwanda and Nigeria or Germany's

membership in the Powering Past Coal Alliance. Most recently, Germany and South Africa have joined forces through the Just Energy Transition Partnership that aims at facilitating South Africa's coal phase-out and is strongly supported by Germany.

### **Summary of findings**

Just energy transition is part of an economy-wide low-carbon development required to implement the international commitments of the Paris Agreement and the 2030 Agenda. However, the goals of the two international agendas are strongly interlinked (Brandi et al. 2017; Dzebo et al. 2018, 2019; Gomez-Echeverri 2018; Laumann et al. 2020; Chan et al. 2021; Iacobață et al. 2021) and this is also reflected at the national level – efforts to achieve one objective can support or undermine other objectives. As Germany and South Africa are currently at very different stages of achieving the social, economic and environmental SDG targets, their development priorities and capabilities are very different. While Germany is economically and politically able to provide social security nets, technology and knowledge for such a transition, South Africa's high reliance on coal makes the energy transition a question of political economy with multiple interests at play. Moreover, while Germany already has decades of experience in implementing energy transition policies due to its coal phase-out in the Ruhr area, South Africa is currently experimenting in more incipient stages of developing and implementing policy programmes that aim for a just energy transition.

## **IV. Discussion and conclusion**

Our research demonstrated two core contributions: First, we developed a conceptual framework by combining theoretical and practical approaches of a just energy transition, taking into account potential synergies and trade-offs with sustainable development and climate goals. Second, we applied our framework to a comparative analysis of two highly coal-dependent countries with different social, economic and political backgrounds (i.e. Germany and South Africa). Through these diverse country settings and conditions when implementing energy transitions, we showcase how the just energy transition framework can identify gaps and opportunities for measures that respond to country-specific needs and provide evaluative and normative solutions.

Our findings reveal that both countries, Germany and South Africa, regardless of their socio-economic and political backgrounds face multiple challenges in planning and implementing a just energy transition. Such challenges can be observed along all three tenets of energy justice – regarding the distribution of benefits and ills (distributional justice), the recognition of vulnerable groups (recognition justice) and the representation of all affected stakeholders in respective institutions (procedural justice). Yet, differences in how countries can and do approach these challenges exist. For instance, Germany as a country with high state capacity and financial means can provide compensations and social protection policies to affected and vulnerable groups. South Africa, as a defective democracy with high levels of unemployment, cannot provide such a prerequisite. Although Germany already has decades of experience in energy transition, financial resources and policies at its disposal, the country's coal phase-out timeline is not in line with the Paris Agreement. Moreover, key trade-offs with the implementation of SDGs 1, 6,

8 and 15 in particular emerge. In South Africa, the position of power and strong interests of the electricity provider Eskom and labour unions, as well as the high economic dependence on coal, make just energy transition policies challenging to implement. The country's socioeconomic challenges specifically with regard to SDGs 1, 8 and 10 require the inclusion of vulnerable stakeholders, thereby shifting away from top-down decision-making.

The limitations of our study provide potential future research opportunities. Since our study did not assess the implementation of SDGs and climate goals at the target level, quantitative data collection to evaluate SDG indicators and NDCs implementation in the context of a just energy transition could provide important insights into the country's related challenges and performance of measures. Moreover, we did not interview affected stakeholders on the local level. Additional qualitative data collection on local level could assess if just energy transition policies, such as social dialogue and skills training are successfully implemented on the ground. Future inter- and transdisciplinary research is needed to analyse just energy transition as a means to jointly implement (inter-)national climate and sustainability goals. Critical approaches of energy, climate, social and environmental justice, systems thinking, global South perspectives, and considerations of past and future injustices are needed to promote and support far-reaching low-carbon transitions.

Ensuring a just energy transition is one of the major challenges that countries face when implementing the ambitious goals of the 2030 Agenda and the Paris Agreement. This is especially the case for countries that struggle to shift their economy from one energy regime to another, pressured by established businesses and political power bases, intensive costs and job losses, unequally distributed benefits and ills, interconnected cultural identity and a tight timeline for decarbonization. The successful implementation of the 2030 Agenda and the Paris Agreement require a paradigm shift away from current trajectories, while ensuring that no one is left behind. Our framework supports the implementation of such a paradigm shift by integrating concepts of energy justice with concrete measures that alleviates trade-offs and enhances justice for all, providing a practical policy tool and frame for discussions.

Our framework could be used by both researchers and policymakers working on the just energy transition topic. Researchers could use the framework to assess how the just energy transition is implemented by countries, both in policy content and on the ground, at the local level, with a view to the tenets of justice and supportive governance arrangements and policy measures. Policymakers could use the framework as a policy design toolbox to review if they consider the measures of the just energy transition framework in planning, formulation and implementation of a just energy transition. Moreover, researchers and policymakers could assess which SDGs benefit or collide with the implementation of a just energy transition in a country-specific context.

## Notes

1. The Paris Agreement, adopted in 2015 and joined by 194 nations by the end of 2021, aims to tackle the threat of climate change. in the context of sustainable development and efforts to eradicate poverty .

2. The 2030 Agenda with its 17 Sustainable Development Goals (SDGs) was adopted by all 193 United Nations Member States at the General Assembly of 2015 and signed through Resolution A/RES/70/1. The SDGs address, in broad terms, poverty (SDG 1), food (SDG 2), health (SDG 3), education (SDG 4), gender equality (SDG 5), water (SDG 6), energy (SDG 7), jobs and the economy (SDG 8), industry and infrastructure (SDG 9), human settlements (SDG 11), sustainable consumption and production (SDG 12), climate change (SDG 13), oceans (SDG 14), life on land (SDG 15), peace and justice (SDG 16), partnerships (SDG 17).

## Abbreviations

AIDC	Alternative Information and Development Centre
DEA	Department of Environmental Affairs
EU	European Union
FiTs	Feed-in Tariffs
ILO	International Labour Organisation
IRP	Integrated Resource Plan
NABU	Nature and Biodiversity Conservation Union
NDCs	Nationally Determined Contributions
NEVA	National Employment Vulnerability Assessment
NDP	National Development Plan
OMCJ	One Million Climate Jobs Initiative
PCCCC	Presidential Climate Change Coordinating Commission
PPCA	Powering Past Coal Alliance
REI4P	Independent Power Producer Procurement Programme
SDGs	Sustainable Development Goals
SJRPs	Sector Job Resilience Plans
VNR	Voluntary National Review
WEFL	Water-Energy-Food-Land

## Acknowledgments

We would like to thank our colleagues at German Institute of Development and Sustainability (IDOS), Stockholm Environment Institute, Linköping University and Utrecht University for providing an inspiring environment to work on the just transition topic. We would also like to thank the two anonymous reviewers that have generously shared their critical insights and comments, and the editors of this special issue.

## Data Availability Statement

Due to the nature of this research and for ethical reasons, detailed interview transcripts will not be shared publicly, so supporting data are not available. Authors guaranteed the anonymity of interviewees. Yet, the authors provide their interview guidelines, a table with the indicators for country case selection, as well as a list of the analysed policy documents in the supplementary material.

## Disclosure statement

No potential conflict of interest was reported by the author(s).



## Funding

This work was supported by the Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung [2018.9587.9]; Swedish Research Council [2018-02324\_5].

## References

- Ahirwal J, and Maiti SK. 2021. Restoring coal mine degraded lands in India for achieving the United Nations-sustainable development goals. *Restor Ecol* 30 (5). e13606 doi:10.1111/rec.13606.
- Ahmad MI, and Riffat S. 2020. Introduction: energy, green innovation and sustainable future Ahmad, MI, Riffat, S eds. . In: Energy recovery technology for building applications. Green Innovation towards a Sustainable Future. Cham: Springer; p. 1–4 doi:10.1007/978-3-030-50006-1.
- Alola AA, Yalçiner K, Alola UV. 2019. Renewables, food (in) security, and inflation regimes in the coastline Mediterranean countries (CMCs): the environmental pros and cons. *Environ Sci Pollut Res*. 26(33):34448–34458. doi:10.1007/s11356-019-06576-y.
- Analytics C. 2018. Science based coal phase-out pathway for Germany in line with the *Paris Agreement* 1.5°C warming limit: opportunities and benefits of an accelerated energy transition.
- Appun K, Wettengel J. 2019. Germany's climate action law takes shape. *Clean Energy Wire*.
- Bernard HR. 2006. *Research methods in anthropology*. Lanham: AltaMira Press.
- BMU. 2019. *Bundes-Klimaschutzgesetz (KSG)*. [https://www.bmu.de/fileadmin/Daten\\_BMU/Download\\_PDF/Gesetze/191118\\_ksg\\_lesefassung\\_bf.pdf](https://www.bmu.de/fileadmin/Daten_BMU/Download_PDF/Gesetze/191118_ksg_lesefassung_bf.pdf)
- BMWi. 2018. Bruttobeschäftigung durch erneuerbare Energien 2000 bis 2018. [https://www.erneuerbare-energien.de/EE/Redaktion/DE/Downloads/zeitreihe-der-beschaefigungszahlen-seit-2000.pdf;jsessionid=00FCF46E5A6C30D2B74FA772059CF500?\\_\\_blob=publicationFile&v=3](https://www.erneuerbare-energien.de/EE/Redaktion/DE/Downloads/zeitreihe-der-beschaefigungszahlen-seit-2000.pdf;jsessionid=00FCF46E5A6C30D2B74FA772059CF500?__blob=publicationFile&v=3)
- BMWi. 2020a. *Entwurf eines Gesetzes zur Reduzierung und zur Beendigung der Kohleverstromung und zur Änderung weiterer Gesetze (Kohleausstiegsgesetz)*. [https://www.bmwi.de/Redaktion/DE/Downloads/G/gesetzesentwurf-kohleausstiegsgesetz.pdf?\\_\\_blob=publicationFile&v=8](https://www.bmwi.de/Redaktion/DE/Downloads/G/gesetzesentwurf-kohleausstiegsgesetz.pdf?__blob=publicationFile&v=8)
- BMWi. 2020b. *Entwurf eines Strukturstärkungsgesetzes Kohleregionen*. [https://www.bmwi.de/Redaktion/DE/Downloads/E/entwurf-eines-strukturstaerkungsgesetzes-kohleregionen.pdf?\\_\\_blob=publicationFile&v=12](https://www.bmwi.de/Redaktion/DE/Downloads/E/entwurf-eines-strukturstaerkungsgesetzes-kohleregionen.pdf?__blob=publicationFile&v=12).
- Brandt C, Dzebo A, and Janetschek H. 2017. *The case for connecting the implementation of the Paris Climate Agreement and the 2030 Agenda for Sustainable Development* Briefing Paper . German Development Institute/ Deutsches Institut für Entwicklungspolitik (DIE).
- Brauers H, and Oei PY. 2020. The political economy of coal in Poland: drivers and barriers for a shift away from fossil fuels. *Energy Policy*. 144:111621. doi:10.1016/j.enpol.2020.111621.
- Breuer A, Janetschek H, Malerba D. 2019. Translating sustainable development goal (SDG) interdependencies into policy advice. *Sustainability*. 11(7):1–20. doi:10.3390/su11072092.
- BTI. 2018. *Bertelsmann Transformation Index*. <https://www.bti-project.org/en/home.html?&cb=00000> .
- Buchsbaum ML. 2019. *Rheinisch revolutionary weekend: citizen demand more action on climate*, in *Energy Transition*.
- Cape L, and van der Westhuizen C. 2015. Strategic assessment for renewable energy in South Africa. Muldersdrift, Gauteng: ee publishers.
- Carraro L, and Marzi MS. 2021. Effects of social protection on poverty and inequality Schüring, E, Loewe, M eds. . In: Handbook on social protection systems. Cheltenham: Edward Elgar Publishing; p. 582–595 .
- CAT. 2019. *Climate Action Tracker 2019 Country Reports*. <https://climateactiontracker.org/countries/>.
- CAT. 2020. *Climate Action Tracker*. <https://climateactiontracker.org/countries/>.
- CAT. 2021a. *Germany's proposed 2030 national target not yet 1.5°C-compatible*. [https://climateactiontracker.org/documents/858/CAT\\_2021-05\\_GermanysProposed2030NationalTarget.pdf](https://climateactiontracker.org/documents/858/CAT_2021-05_GermanysProposed2030NationalTarget.pdf).
- CAT. 2021b. *CAT Climate Target Update Tracker. South Africa*. <https://climateactiontracker.org/climate-target-update-tracker/south-africa/> .

- Chan S, Iacobuță G, and Hägele R. 2021. Maximising goal coherence in sustainable and climate-resilient development? Chaturvedi, S, Janus, H, Li, X, Mello e Souza, A.D, Sidiropoulos, E, Wehrmann, D eds. In: *The Palgrave handbook of development cooperation for achieving the 2030 agenda*. Cham: Palgrave Macmillan; p. 25–50.
- Clark H, Ayuso-Audry, A, Falkenberg, K, Helias, V, Li, L, Mniki-Mangaliso, N, Oorthuizen, J, Ribera, T, Strandenaes, J.G, and Ullah, F. 2018. *The 2018 Peer Review on the German Sustainability Strategy*. Report by the International Peer Group chaired by Helen Clark: Berlin.
- Climate Home News. 2019. Campaigners and industry criticise South Africa's new carbon tax. Climate Home News. [https://www.climatechangenews.com/2019/07/17/campaigners-industry-criticise-south-africas-new-carbon-tax/?fbclid=IwAR3j9Iz4DIxHHAuUm1MKZMXgR1eaGZjy15d\\_SXh3u-f8L-Ykg26h4poUfbQ](https://www.climatechangenews.com/2019/07/17/campaigners-industry-criticise-south-africas-new-carbon-tax/?fbclid=IwAR3j9Iz4DIxHHAuUm1MKZMXgR1eaGZjy15d_SXh3u-f8L-Ykg26h4poUfbQ).
- Cock J. 2019. Resistance to coal inequalities and the possibilities of a just transition in South Africa. *Dev South Afr.* 36(6):860–873. doi:10.1080/0376835X.2019.1660859.
- Cohen M. 2019. *Eskom Woes Have No End in Sight as S. Africa Bailout Bill Mounts*. <https://www.bloomberg.com/news/articles/2019-10-30/eskom-woes-have-no-end-in-sight-as-s-africa-bailout-bill-mounts>
- Comyn PJ. 2018. Skills, employability and lifelong learning in the sustainable development goals and the 2030 labour market. *Int J Train Res.* 16(3):200–217. doi:10.1080/14480220.2018.1576311.
- COP24, . 2018. *Just Transition Declaration*. Katowice: COP24.
- COP26. 2021. *Political declaration on the just energy transition in South Africa*. 2021: UN Climate Change Conference UK, Glasgow.
- Creamer T. 2020. *Presidential climate change coordinating commission seen as key to navigating South Africa's 'just transition'*. Engineering News.
- Department of Energy. 2019. *Integrated Resource Plan (IRP2019)*. [https://www.gov.za/sites/default/files/gcis\\_document/201910/42778gon1359.pdf](https://www.gov.za/sites/default/files/gcis_document/201910/42778gon1359.pdf)
- Dombrowsky I, Hensengerth O. 2018. Governing the water-energy-food nexus related to hydro-power on shared rivers—the role of regional organizations. *Front Environ Sci.* 6(153). doi:10.3389/fenvs.2018.00153.
- Dzebo A, Janetschek, H, Brandi, C, and Iacobuță, G, et al. 2018. *The Sustainable Development Goals viewed through a climate lens*. SEI policy brief . Stockholm: Stockholm Environment Institute.
- Dzebo A, Janetschek, H, Brandi, C, and Iacobuță, G, et al. 2019 *Connections between the Paris Agreement and the 2030 Agenda. The case for policy coherence Working Paper* (Stockholm: Stockholm Environment Institute) . .
- Europe Beyond Coal. 2017. *Europe's dark cloud - 2015 results update. Briefing Paper*. p. 1–6.
- European Commission. 2020. *Financing the green transition: The European green deal investment plan and just transition mechanism*. [https://ec.europa.eu/regional\\_policy/en/newsroom/news/2020/01/14-01-2020-financing-the-green-transition-the-european-green-deal-investment-plan-and-just-transition-mechanism](https://ec.europa.eu/regional_policy/en/newsroom/news/2020/01/14-01-2020-financing-the-green-transition-the-european-green-deal-investment-plan-and-just-transition-mechanism)
- European Commission. 2021. *The Just Transition Mechanism: making sure no one is left behind*. [https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/finance-and-green-deal/just-transition-mechanism\\_en](https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/finance-and-green-deal/just-transition-mechanism_en).
- European Union. 2020. *The update of the nationally determined contribution of the European Union and its member states*.
- Evans G, Phelan L. 2016. Transition to a post-carbon society: linking environmental justice and just transition discourses. *Energy Policy.* 99:329–339. doi:10.1016/j.enpol.2016.05.003.
- Franco IB, Power C, and Whereat J. 2020. *SDG 7 affordable and clean energy* Franco, IB, Chatterji, T, Derbyshire, E, Tracey, J. In: *Actioning the global goals for local impact. Towards Sustainability Science, Policy, Education and Practice*. Singapore: Springer; p. 105–116.
- Fraunhofer ISE. 2020. *Public net electricity generation in Germany 2019: Share from renewables exceeds fossil fuels*. <https://www.ise.fraunhofer.de/en/press-media/news/2019/Public-net-electricity-generation-in-germany-2019.html>
- Gagnebin M, Graichen P, Lenck T. 2019. *Learning from the yellow vest protests: on the relationship between climate protection, CO2 prices and social justice, in agora energiewende*.

- Galgóczi B. 2018. *From Paris to Katowice: the EU needs to step up its game on climate change and set its own just transition framework*. ETUI Research Paper-Policy Brief. 4.
- Gedye L. 2018. Coal workers demand a just energy transition. New Frame.
- Gerbens-Leenes W, Hoekstra AY. 2011. The water footprint of biofuel-based transport. *Energy Environ Sci*. 4(8):2658–2668. doi:10.1039/c1ee01187a.
- German Federal Environment Agency. 2020. Treibhausgasmindierungswirkung des Klimaschutzprogramms 2030 (Kurzbericht).
- German Federal Government, *Report of the German federal government to the high-level political forum on sustainable development 2016*. 2016.
- German Federal Government. 2020. Investitionsgesetz Kohleregionen. Bonn: Bundesministerium der Justiz.
- German Federal Government. 2021a. *Klimaschutzgesetz 2021: Generationenvertrag für das Klima*. Available from: <https://www.bundesregierung.de/breg-de/themen/klimaschutz/klimaschutzgesetz-2021-1913672>.
- German Federal Government. 2021b. Gesetz für den Ausbau erneuerbarer Energien. Bundesministerium der Justiz.
- German Federal Government, 2021c, *German Voluntary National Review to the HLPF 2021. Report on the implementation of the 2030 Agenda for sustainable development*. 2021c [https://hlpf.un.org/sites/default/files/vnrs/2021/279522021\\_VNR\\_Report\\_Germany.pdf](https://hlpf.un.org/sites/default/files/vnrs/2021/279522021_VNR_Report_Germany.pdf).
- Goddard G, Farrelly MA. 2018. Just transition management: balancing just outcomes with just processes in Australian renewable energy transitions. *Appl Energy*. 225:110–123. doi:10.1016/j.apenergy.2018.05.025.
- Gomez-Echeverri L. 2018. *Climate and development: enhancing impact through stronger linkages in the implementation of the Paris agreement and the sustainable development goals (SDGs)*. *Philosophical transactions of the royal society A: mathematical, Phys Eng Sci*. 376(2119):20160444.
- Greenberg P. 2018. Coal waste, socioeconomic change, and environmental inequality in Appalachia: implications for a just transition in coal country. *Soc Nat Resour*. 31(9):995–1011. doi:10.1080/08941920.2018.1456593.
- GSDS. 2018. German Sustainable Development Strategy. 2018 Update. Berlin: Publikationsversand der Bundesregierung.
- Hägele R, and Mathis OL A chance to build a better future. From COVID-19 to climate action . 2020. In: The current column of 25 May 2020. Bonn: German Development Institute/ Deutsches Institut fuer Entwicklungspolitik (DIE).
- Haines A, Smith KR, Anderson D, Epstein PR, McMichael AJ, Roberts I, Wilkinson P, Woodcock J, Woods J. 2007. Policies for accelerating access to clean energy, improving health, advancing development, and mitigating climate change. *Lancet*. 370(9594):1264–1281. doi:10.1016/S0140-6736(07)61257-4.
- Healy N, Barry J. 2017. Politicizing energy justice and energy system transitions: fossil fuel divestment and a “just transition”. *Energy Policy*. 108:451–459. doi:10.1016/j.enpol.2017.06.014.
- Heffron R, McCauley D. 2017. The concept of energy justice across the disciplines. *Energy Policy*. 105:658–667. doi:10.1016/j.enpol.2017.03.018.
- Heffron RJ, McCauley D. 2018. What is the ‘just transition’? *Geoforum*. 88:74–77. doi:10.1016/j.geoforum.2017.11.016.
- Hepburn C, O’Callaghan B, Stern N, Stiglitz J, Zenghelis D. 2020. Will COVID-19 fiscal recovery packages accelerate or retard progress on climate change? *Oxf Rev Econ Policy*. 36 (Supplement\_1):359–381. doi:10.1093/oxrep/graa015.
- Iacobuță GI, Höhne N, van Soest HL, Leemans R. 2021. Transitioning to low-carbon economies under the 2030 agenda: minimizing trade-offs and enhancing co-benefits of climate-change action for the sdgs. *Sustainability*. 13(19):10774. doi:10.3390/su131910774.
- IEA. 2019. *Share of global power mix 2019*. <https://www.iea.org/fuels-and-technologies/coal>
- ILO. 2019. *Advancing a Just Transition and the Creation of Green Jobs for All for Ambitious Climate Action*. [https://www.ilo.org/wcmsp5/groups/public/—ed\\_emp/—emp\\_ent/documents/generic\\_document/wcms\\_715201.pdf](https://www.ilo.org/wcmsp5/groups/public/—ed_emp/—emp_ent/documents/generic_document/wcms_715201.pdf).

- Independent Power Producers Office. 2019. *Independent Power Producer Procurement Programme*. <https://www.ipp-renewables.co.za/>.
- Interviewee 1. 2019. Semi-structured interview (in person). Bonn.
- Interviewee 2. 2019. Semi-structured interview (in person). Bonn.
- Interviewee 3. 2019. Semi-structured interview (in person). Bonn.
- Interviewee 4. 2019. Semi-structured interview (virtual). via telephone.
- Interviewee 5. 2019. Semi-structured interview (in person). Copenhagen.
- Interviewee 6. 2019. Semi-structured interview (virtual). via Skype.
- Interviewee 7. 2019. Semi-structured interview (virtual). via Skype.
- Interviewee 8. 2019. Semi-structured interview (in person). Bonn.
- Interviewee 9. 2019. Semi-structured interview (virtual). via Skype.
- ITUC. 2019. *International Trade Union Confederation*. <https://www.ituc-csi.org/just-transition-centre?lang=en>
- Jagger P, Bailis, R, Dermawan, A, Kittner, N, and McCord, R, et al. 2019 SDG 7: affordable and clean energy—how access to affordable and clean energy affects forests and forest-based livelihoods Katila, P, Colfer, CJP, De Jong, W, Pacheco, P, Winkel, G eds. . *Sustainable development goals: their impacts on forests and people*. Cambridge: Cambridge University Press; p. 206–236.
- Janikowska O, Kulczycka J. 2021. Just transition as a tool for preventing energy poverty among women in mining areas—A case study of the Silesia Region. *Poland Energies*. 14(12):3372. doi:10.3390/en14123372.
- Jenkins K, McCauley D, Heffron R, Stephan H, Rehner R. 2016. Energy justice: a conceptual review. *Energy Res Social Sci*. 11:174–182. doi:10.1016/j.erss.2015.10.004.
- Jenkins KEH, Sovacool BK, Błachowicz A, Lauer A. 2020. Politicising the just transition: linking global climate policy, nationally determined contributions and targeted research agendas. *Geoforum*. 115:138–142. doi:10.1016/j.geoforum.2020.05.012.
- Kern V, Meier F. *Das sind die Mitglieder der Kohlekommission*. 2018; Available from: <https://www.klimareporter.de/deutschland/das-sind-die-mitglieder-der-kohlekommission> .
- Kohlbacher F. 2006. The use of qualitative content analysis in case study research. *Forum qualitative Sozialforschung/Forum: qualitative Social Research* 7(1): 1–30.
- Laumann F, von Kügelgen J, Barahona M. 2020. Non-linear interlinkages and key objectives amongst the Paris Agreement and the sustainable development goals. arXiv Preprint arXiv:2004.09318.
- Le Blanc D. 2015. Toward integration at last? The sustainable development goals as a network of targets. *Sustain Dev*. 23(3):176–187. doi:10.1002/sd.1582.
- Liu J, Zhao, D, Gerbens-Leenes, PW, and Guan, D, et al. 2015. China's rising hydropower demand challenges water sector. *Sci Rep*. 5(1):1–14.
- Mago S. 2017 North–South research collaboration and the sustainable development goals: challenges and opportunities for academics. In: Halvorsenand, T, Ibsen, H, Evans, HC, Penderis, S eds. *Knowledge for justice. Critical perspectives from southern African-Nordic research partnerships*. Cape Town: African Minds:163–174.
- Mahlknecht J, González-Bravo R, Loge FJ. 2020. Water-energy-food security: a Nexus perspective of the current situation in Latin America and the Caribbean. *Energy*. 194:116824. doi:10.1016/j.energy.2019.116824.
- Mailula T. 2019. *South Africa is Moving Slowly Away from Coal*. Climate Scorecard. <https://www.climate-scorecard.org/2019/05/south-africa-is-moving-slowly-away-from-coal/>
- Matthes F, Hermann H, Mendelevitch R. 2020. Einordnung der geplanten Entschädigungszahlungen für die Stilllegungen deutscher Braunkohlekraftwerke im Kontext aktueller Entwicklungen. Berlin.
- Matthews DH, Tokarska K. 2021. New research suggests 1.5C climate target will be out of reach without greener COVID-19 recovery plans. *The Conversation*.
- Matthews DH, Tokarska, KB, Nicholls, ZR, Rogelj, J, Canadell, JG, Friedlingstein, P *et al* . 2020. Opportunities and challenges in using remaining carbon budgets to guide climate policy. *Nat Geosci*. 13(12):769–779.
- Mayring P. 2015. Qualitative content analysis: theoretical background and procedures. In: Bikner-Ahsbahs, A, Knipping, C, Presmeg, N eds. *Approaches to qualitative research in mathematics education*. Dordrecht: Springer; p. 365–380.

- McCauley D, Heffron R. 2018. Just transition: integrating climate, energy and environmental justice. *Energy Policy*. 119:1–7. doi:10.1016/j.enpol.2018.04.014.
- McCollum DL, Zhou W, Bertram C, de Boer H-S, Bosetti V, Busch S, Després J, Drouet L, Emmerling J, Fay M. 2018. Energy investment needs for fulfilling the Paris agreement and achieving the sustainable development goals. *Nat Energy*. 3(7):589–599. doi:10.1038/s41560-018-0179-z.
- McDaid L. 2016. Renewable Energy Independent Power Producer Procurement Programme Review 2016: a critique of process of implementation of socio-economic benefits including job creation. AIDC: Alternative Information & Development Centre.
- Mejía-Montero A, Alonso-Serna L, and Altamirano-Allende C. 2020 The role of social resistance in shaping energy transition policy in Mexico: the case of wind power in Oaxaca. *The Regulation and Policy of Latin American Energy Transitions*. Elsevier:303–318.
- Meles TH, Ryan L, Wheatley J. 2020. COVID-19 and EU climate targets: can we now go further? *Environ Resour Econ*. 76(4):779–787. doi:10.1007/s10640-020-00476-3.
- Mercier S. 2020. Four case studies on just transition: lessons for Ireland. National Economic and Social Council, 'Four Case Studies on Just Transition: Lessons for Ireland', Research Series Paper. 15.
- Mill JS. 1884. *A system of logic, ratiocinative and inductive: being a connected view of the principles of evidence and the methods of scientific investigation*. Vol. 1. New York: Harper.
- Moch F. 2019. *German "Coal Commission" as an example of a just transition? Presented at the Climate & SDGs synergy conference*. Copenhagen, April 1st 2019.
- Montmasson-Clair G. 2017 Electricity supply in South Africa: path dependency or decarbonisation?. *Policy Brief 2/2017*. Pretoria: Trade & Industrial Policy Strategies (TIPS).
- Morgan S. 2020. Poland, Germany get largest slices of just transition fund. EURACTIV.
- Müller K. 2017. The energy transition. Future lab Germany – a joint effort. In: RNE editor, *German Almanac of Sustainability. Initiatives and impressions on the social reality of sustainability*. Berlin: German Council for Sustainable Development: 101–121.
- Müller F, Neumann M, Elsner C, Claar S. 2021. Assessing African energy transitions: renewable energy policies, energy justice, and SDG 7. *Politics Gov*. 9(1):119–130. doi:10.17645/pag.v9i1.3615.
- NABU. 2016. *Naturverträgliche Nutzung der Windenergie an Land und auf See*. In: NABU Positionspapier. Berlin: NABU 1–16 .
- NCE. 2018. *Unlocking the inclusive growth story of the 21st century: accelerating climate action in urgent times*. New Climate Economy:Washington.
- Nebe C. 2021. *South Africa's looters pounce after Zuma jailing*. Deutsche Welle. <https://www.dw.com/en/south-africas-looters-pounce-after-zuma-jailing/a-58264509>.
- Nerini FF, Tomei J, To LS, Bisaga I, Parikh P, Black M, Borrion A, Spataru C, Castán Broto V, Anandarajah G, et al. 2018. Mapping synergies and trade-offs between energy and the sustainable development goals. *Nat Energy*. 3(1):10–15. doi:10.1038/s41560-017-0036-5
- Newell P, Mulvaney D. 2013. The political economy of the 'just transition'. *Geogr J*. 179(2):132–140. doi:10.1111/geoj.12008.
- Nikas A, Neofytou, H, Karamaneas, A, Koasidis, K, and Psarras, J . 2020. *Sustainable and socially just transition to a post-lignite era in Greece: a multi-level perspective*. *Energy Sources, Part B: Econ Plan Policy*. 15(10–12):513–544.
- NPC. 2019. *Proposals for a social compact on pathways for a just transition*. Social Partner Dialogue for a Just Transition.
- Núñez RBC, Bandeira P, Santero-Sánchez R. 2020. Social economy, gender equality at work and the 2030 agenda: theory and evidence from Spain. *Sustainability*. 12(12):5192. doi:10.3390/su12125192.
- Oei P-Y. 2018. *Greenhouse gas emission reductions and the phasing-out of coal in Germany*. In: von Hirschhausen, C, Gerbaulet, C, Kemfert, C, Lorenz, C, Oei, P-Y eds. *Energiewende "Made in Germany"*. Cham: Springer:81–116.
- Oei P-Y, Kendzioriski, M, Herpich, P, Kemfert, C, and von Hirschhausen, C 2020. *Klimaschutz statt Kohleschmutz: woran es beim Kohleausstieg hakt und was zu tun ist (No. 148)*. Politikberatung kompakt. Berlin: Deutsches Institut für Wirtschaftsforschung



- Oei P-Y, Lorenz, C, Schmalz, S, Brauers, H, Herpich, P, von Hirschhausen, C, Kemfert, C *et al.* . 2019. Klimaschutz und Kohleausstieg: politische Strategien und Maßnahmen bis 2030 und darüber hinaus. Dessau-Roßlau: Umweltbundesamt.
- Our world in data. 2019. *Share of electricity production from coal*. <https://ourworldindata.org/grapher/share-electricity-coal>
- Pahl-Wostl C. 2019. Governance of the water-energy-food security nexus: a multi-level coordination challenge. *Environ Sci Policy*. 92:356–367. doi:10.1016/j.envsci.2017.07.017.
- Pai S, Harrison K, Zerriffi H. 2020. A systematic review of the key elements of a just transition for fossil fuel workers. Ottawa, ON, Canada: Smart Prosperity Institute.
- Pellegrini-Masini G, Pirni A, Maran S. 2020. Energy justice revisited: a critical review on the philosophical and political origins of equality. *Energy Res Social Sci*. 59:101310. doi:10.1016/j.erss.2019.101310.
- Petrie B, Wolpe P, Reddy Y, Adriázola P, Gerhard M, Landesman T, Strauch L, Marie A. 2018. Multi-level climate governance in South Africa. catalysing finance for local climate action. adelphi: OneWorld, Sustainable Energy Africa.
- Pfister S, Scherer L, Buxmann K. 2020. Water scarcity footprint of hydropower based on a seasonal approach-Global assessment with sensitivities of model assumptions tested on specific cases. *Sci Total Environ*. 724:138188. doi:10.1016/j.scitotenv.2020.138188.
- Pianta M, Lucchese M. 2020. Rethinking the European green deal: an industrial policy for a just transition in Europe. *Rev Radic Political Econ*. 52(4):633–641. doi:10.1177/0486613420938207.
- Plagerson S, Ulriksen MS. 2016. Can social protection address both poverty and inequality in principle and practice? *Glob Soc Policy*. 16(2):182–200. doi:10.1177/1468018115622521.
- Pollin R, Callaci B. 2019. The economics of just transition: a framework for supporting fossil fuel-dependent workers and communities in the United States. *Labor Stud JI*. 44(2):93–138. doi:10.1177/0160449X18787051.
- Praetorius B, Bandt O, Grothus A, Kaiser M, Matthes FC, Niebert K, Schellnhuber HJ. 2020. Stellungnahme der ehemaligen Mitglieder der Kommission Wachstum, Strukturwandel und Beschäftigung (KWSB). Stellungnahme.
- Quitow R, Thielges S, Goldthau A, Helgenberger S, Mbungu G. 2019. Advancing a global transition to clean energy—the role of international cooperation. *Economics*. 13(1). doi:10.5018/economics-ejournal.ja.2019-48.
- Ragin CC. 2000. *The comparative method: moving beyond qualitative and quantitative strategies*. Berkeley: University of California Press [1987].
- Reitzenstein A, Popp R. 2019. *The German coal commission – a role model for transformative change?*, Briefing Paper E3G.
- Rennkamp B. 2012. *Sustainable development planning in South Africa: a case of over-strategizing?* Berlin Conference on Human Dimensions of Global Environmental Change. Berlin.
- Ritchie H, and Roser M. 2019a. CO<sub>2</sub> and Greenhouse Gas Emissions. Online: OurWorldInData <https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions#citation> .
- Ritchie H, and Roser M. 2019b. Fossil Fuels. Online: OurWorldInData <https://ourworldindata.org/fossil-fuels> .
- Roberts L. 2020. Global status of coal powerPre-Covid19 baseline analysis. E3G.
- Robins N, Tickell, S, Irwin, W, and Sudmant, A . 2020. *Financing climate action with positive social impact. How banking can support a just transition in the UK*. London, UK: Grantham research institute on climate change and the environment ,LSE.
- Roff A, Steyn G, Tyler E, Renaud C, Brand R, and Burton J . 2020. A vital ambition - determining the additional CO<sub>2</sub> emission mitigation in the South African electricity system. <https://meridianomics.co.za/wp-content/uploads/2020/07/Ambition.pdf>.
- Roy J, Tschakert, P, and Waisman, H . 2018. Sustainable development, poverty eradication and reducing inequalities. In: . *Global warming of 1.5°C: an IPCC special report*. Cambridge University Press: Cambridge. p. 445–538
- Roy A, Kuruvilla B, and Bhardwaj A. 2019. Energy and climate change: a just transition for Indian labour. In: Dubash, NK ed. *India in a warming world. Integrating Climate Change and Development*. Oxford: Oxford University Press; p. 284–300 doi:10.1093/oso/9780199498734.003.0017.

- Rulli MC, Bellomi D, Cazzoli A, De Carolis G, D'Odorico P. 2016. The water-land-food nexus of first-generation biofuels. *Sci Rep.* 6(1):1–10. doi:10.1038/srep22521.
- SA News. 2020a. *Recovery plan for mining and energy sectors*. <https://www.sanews.gov.za/south-africa/recovery-plan-mining-and-energy-sectors>
- SA News. 2020b. *President appoints Climate Change Coordinating Commission*. <https://www.sanews.gov.za/south-africa/president-appoints-climate-change-coordinating-commission>
- Sachs JD, Schmidt-Traub G, Mazzucato M, Messner D, Nakicenovic N, Rockström J, *The Sustainable Development Report 2019*. 2019: Cambridge.
- SARB. 2020. *QPM forecast summary table July 2020*. <https://www.resbank.co.za/Lists/NewsandPublications/Attachments/10114/Forecast>.
- Sarrica M, Richter M, Thomas S, Graham I, Mazzara BM. 2018. Social approaches to energy transition cases in rural Italy, Indonesia and Australia: iterative methodologies and participatory epistemologies. *Energy Res Social Sci.* 45:287–296. doi:10.1016/j.erss.2018.07.001.
- Schulz F. 2020. Breakthrough in Germany's wind and solar energy dispute. Euroactive.
- Shawoo Z, Dzebo, A, Haegele, R, Iacoubta, G, Chan, S, Muhoza, C, Osano, P, Francisco, M, Persson, A, Linner, BO, and Vijge, MJ. 2020. Increasing policy coherence between NDCs and SDGs: a national perspective. *Sei policy brief*. Stockholm: Stockholm Environment Institute.
- Singh GG, Oduber M, Cisneros-Montemayor AM, Ridderstaat J. 2021. Aiding ocean development planning with SDG relationships in small Island developing states. *Nat Sustain.* 4(7):573–582. doi:10.1038/s41893-021-00698-3.
- Snell D. 2018. 'Just transition'? Conceptual challenges meet stark reality in a 'transitioning' coal region in Australia. *Globalizations.* 15(4):550–564. doi:10.1080/14747731.2018.1454679.
- South African Government. 2010. *The new growth path: the framework*.
- South African Government. 2012. *National development plan 2030. Our future – make it work. Executive Summary*.
- South African Government. 2019. *South Africa's implementation of the 2030 agenda for sustainable development: solving complex challenges together. Voluntary National Review (VNR)*.
- South African Government. 2021a. *Proposed updated Nationally determined contribution. South Africa's First Nationally Determined Contribution under the Paris agreement*. F.a.t.E. Ministry of Forestry Editor, Updated in 2021.
- South African Government. September 2021b. *South Africa. First nationally determined contribution under the Paris agreement. Updated*.
- Sovacool BK, Dworkin MH. 2015. Energy justice: conceptual insights and practical applications. *Appl Energy.* 142:435–444. doi:10.1016/j.apenergy.2015.01.002.
- Sovacool BK, Hook A, Martiskainen M, Baker L. 2019. The whole systems energy injustice of four European low-carbon transitions. *Global Environl Change.* 58:101958. doi:10.1016/j.gloenvcha.2019.101958.
- Spencer T, Colombier M, Sartor O, Garg A, Tiwari V, Burton J, Caetano T, Green F, Teng F, Wiseman J, et al. 2018. The 1.5 C target and coal sector transition: at the limits of societal feasibility. *Clim Change.* 18(3):335–351. doi:10.1080/14693062.2017.1386540
- Stake RE. 1995. *The art of case study research*. Thousand Oaks, California: Sage Publications.
- Stavis D, Felli R. 2015. *Global labour unions and just transition to a green economy*. International Environmental Agreements: politics. *Law Econ.* 15(1):29–43.
- Strambo C, Burton J, and Atteridge A. 2019. *The end of coal? Planning a "just transition" in South Africa*, SEI report. Stockholm: Stockholm Environment Institute (SEI).
- Svobodova K, Owen JR, Harris J, Worden S. 2020. Complexities and contradictions in the global energy transition: a re-evaluation of country-level factors and dependencies. *Appl Energy.* 265:114778. doi:10.1016/j.apenergy.2020.114778.
- Swain RB, Karimu A. 2020. Renewable electricity and sustainable development goals in the EU. *World Dev.* 125:104693. doi:10.1016/j.worlddev.2019.104693.
- Swilling M, Musango J, Wakeford J. 2016. Developmental states and sustainability transitions: prospects of a just transition in South Africa. *J Environ Policy Plan.* 18(5):650–672. doi:10.1080/1523908X.2015.1107716.



- Theiventhran GM. 2022. Emerging frontiers of energy transition in Sri Lanka. In: Kurochkin D, Crawford MJ, Shabliy EV, editors. Energy policy advancement: climate change mitigation and international environmental justice. Cham: Springer International Publishing; p. 185–210.
- Torres A. A Just Energy Transition: the Social, Political, and Economic Shifts Necessary to Divest from Coal in Colombia. Political, and Economic Shifts Necessary to Divest from Coal in Colombia. May 9, 2019.
- UN General Assembly. 2015. Transforming our world: the 2030 Agenda for Sustainable Development. A/RES/70/1. 21 October .
- UNFCCC. 2016. *Just transition of the workforce, and the creation of decent work and quality jobs. Technical paper.*
- UNU-WIDER. 2015. *World Income Inequality Database (WIID3.4)*. <https://www.wider.unu.edu/database/world-income-inequality-database-wiid34>
- Vaidya H, and Chatterji T. 2020. SDG 11 sustainable cities and communities. In: Franco, IB, Chatterji, T, Derbyshire, E, Tracey, J eds. Actioning the global goals for local impact. Singapore: Springer; p. 173–185.
- Villavicencio Calzadilla P, Mauger R. 2018. The UN's new sustainable development agenda and renewable energy: the challenge to reach SDG7 while achieving energy justice. *J Energy Nat Resour Law*. 36(2):233–254. doi:10.1080/02646811.2017.1377951.
- Wassermann S, Reeg M, Nienhaus K. 2015. Current challenges of Germany's energy transition project and competing strategies of challengers and incumbents: the case of direct marketing of electricity from renewable energy sources. *Energy Policy*. 76:66–75. doi:10.1016/j.enpol.2014.10.013.
- WEF. 2011. *Water security: the Water–Food–Energy– climate Nexus*. Washington:World Economic Forum.
- WEF. 2019. *Fostering effective energy transition*. Geneva: World Economic Forum.[https://www3.weforum.org/docs/WEF\\_Fostering\\_Effective\\_Energy\\_Transition\\_2019.pdf](https://www3.weforum.org/docs/WEF_Fostering_Effective_Energy_Transition_2019.pdf)
- Wehrmann B. 2019. Limits to growth: resistance against wind power in Germany, in *clean energy wire*.
- Weitz N, Strambo C, Kemp-Benedict E, Nilsson M. 2017. Closing the governance gaps in the water-energy-food nexus: insights from integrative governance. *Global Environl Change*. 45:165–173. doi:10.1016/j.gloenvcha.2017.06.006.
- WGI. 2019. *Worldwide Governance Indicators*. <https://datacatalog.worldbank.org/dataset/worldwide-governance-indicators>
- World Bank. 2019a. *Classifying countries by income*. <https://datatopics.worldbank.org/world-development-indicators/stories/the-classification-of-countries-by-income.html>
- World Bank. 2019b. *GDP growth (annual %)*. <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG>
- World Bank. 2020. *GDP growth (annual %)*. <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG> .
- Wörten C, Keppler L, Holzhausen G. 2017. *Arbeitsplätze in Braunkohleregionen – Entwicklungen in der Lausitz, dem Mitteldeutschen und dem Rheinischen Revier*. Kurzstudie für die Bundestagsfraktion Bündnis 90/ Die Grünen. Arepo Consult.
- WSB. 2019. *Kommission „Wachstum, Strukturwandel und Beschäftigung“*. Abschlussbericht.
- Yin RK. 1994. *Case study research: design and methods*. 2nd ed ed. London: Thousand Oaks, California, USA: Sage Publications.
- Zhu E, Campbell L, Hafner M, Lu X, Noussan M, Raimondi PP. 2021. Towards an inclusive energy transition beyond coal-A comparison of just transition policies away from coal between China, the EU and the US. *SSRN Electronic Journal*. doi:10.2139/ssrn.4017432