



# Which states will lead a just transition for the Arctic? A DeePeR analysis of global data on Arctic states and formal observer states

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## ABSTRACT

A fair and equitable low carbon future depends on a just transition which, in turn, requires leadership. Where the Arctic is concerned, this leadership is currently lacking. To gauge which states are most likely to provide leadership in the global energy transition, a quantitative rank-percentile assessment of 21 Arctic Council members and Observer states was conducted, using measures relevant to the just transition. Data from multiple open-access sources were combined, creating a model to 'evaluate energy and equity aspects of Distributional, Procedural and Restorative' justice (DeePeR). Results suggest normative leadership on a just transition for the Arctic comprises international climate contributions in line with carbon emission records and a commitment to both fair and green jobs. Reflections are made on the positive and negative effects of a more involved EU for the just transition agenda in the Arctic.

## 1. Introduction

Let us begin with and maintain a high level of sobriety. No state is effectively, or even ineffectively, leading a climate transition, never mind providing leadership on questions of fairness and equity in the Arctic. The evidence is stark – especially in the Arctic, a region warming three times faster than the global average (IPCC, 2021). The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report concludes, “Human influence is very likely the main driver of the global retreat of glaciers since the 1990 s and the decrease in Arctic Sea ice area between 1979 and 1988 and 2010–2019 (about 40% in September and about 10% in March)” (IPCC, 2021, p. 42). No state, or group of states, businesses, NGOs, political or economic system can claim anything other than failure. Yet with perspective comes purpose. The Arctic needs leadership. So, in relative terms, where can it be found?

Normative leadership, defined as leadership built on moral principles such as justice, is a key factor in the sustainable management of processes and desired outcomes (Allen et al., 2019; Ghorbani et al., 2020; Bakshi, 2021). Strong leadership can drive the creation of shared values, norms, and pathways (Dyrhaug, 2020). It can, inversely, perpetuate unsustainable practices and hinder transitions (Hofstad and

Vedeld, 2021). Existing research shows that institutional leadership in the Arctic is lacking (Chang et al., 2015; Ermida, 2016). The Arctic Council, the region's preeminent multilateral organization established in 1996, is often the focus of debates on how to foster climate change adaptation and mitigation and sustainable development (Chater, 2016; Barry et al., 2020; Stephen and Stephen, 2020; Leksyutina, 2021). Multinational companies are also influential in leadership debates in the Arctic, with the 120 companies included in the Arctic Environmental Responsibility Index exhibiting varying levels of impact (Overland et al., 2021). There is, however, little multi-country research on national government leadership for sustainable transformation in the Arctic. We fill this gap by investigating the role of formal and informal states involved in Arctic affairs and identifying where potential for normative leadership exists. The focus on climate leadership in relation to the Arctic from a national perspective on just transition is entirely novel.

Sustainability transitions involve multiple engaged actors and current measures on environmental, economic, and societal issues (Cohen, 2020). We refer to the leading framework for achieving such transitions as ‘the just transition’ (Abraham, 2017; Carley and Graff, 2020; Le Billon and Kristoffersen, 2020; Thomas, 2021). Begun as a U.S. trade union-based campaign in the 1980 s, early advocates for a ‘just

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transition' called for urgent action on job losses caused by the phasing out of coal mining in Appalachia (Abraham, 2017). More recently, the just transition agenda is reinvigorating international climate action. A dedicated commitment to a just transition is visible in the 2015 UN Paris Agreement, subsequent international agreements such as the UN COP24 Silesia Accord (Presidency, 2018) and in the statements from annual G7 meetings including the most recent 2021 meeting in the UK (G7, 2021, p. 7). We define the just transition as a commitment to a fair and equitable process of moving towards a low carbon future.

### 1.1. Which states are in focus and why?

This study focuses on the eight Member states and thirteen official Observer states to the Arctic Council, the premier forum for regional governance in the Arctic. Leadership from these Member states, which we also sometimes refer to as 'Arctic states,' rather than institutions has yet to be explored in the context of just transition. For clarity, we approach the definitions for our study based on the Arctic Council, which took up its first formal responsibilities in September 1998 from the work of the Arctic Environmental Protection Strategy in 1991 (AC, 1996). The Arctic Council's Member States – all of which possess territory north of the Arctic Circle (approximately 66°30' N) – are Canada, Denmark (including Greenland and the Faroe Islands), Finland, Iceland, Norway, Russia, Sweden, and the USA. This has led to a series of disputes over national territory claims and ownership question, for example with Russia and the US as detailed in Lasserre and Tetu (2020). The AC defines these member states as "carry[ing] a role as stewards of the region. Their national jurisdictions and international law govern the lands surrounding the Arctic Ocean and its waters." (AC, 2021).

The Arctic Council has also had observers since its inception, though their role is transitory and contested. States, supranational organizations (such as the European Union) and non-governmental organizations (such as the World Wildlife Fund) can apply to be observers. Observer states are expected to attend meetings, contribute to working groups, propose projects, and make a formal statement with an Arctic Council member state (AC, 2021). Some reasons why a state or organization might seek official observer status might be to contribute to global environmental governance or sustainable economic development (Chater, 2016). The first period of formal states' observer status accreditation took place in 1998 when Germany, the Netherlands, Poland, and the United Kingdom joined. France and Spain joined in 2000 and 2006, respectively. A major non-European expansion followed this in 2013 with the ascension of China, South Korea, India, Japan and Singapore. Italy and Switzerland have also joined, bringing official observer status as of 2021 to thirteen countries. Even if observer states' influence in the Arctic Council remains constrained, their ability to intervene in the region is likely to rise as a result of their increased participation in both Arctic science and development (Barry et al., 2020; Stephen and Stephen, 2020; Leksyutina, 2021).

The EU as a bloc has unofficial deferred observer status granted at the Kiruna Ministerial meeting in 2013. It was not granted official observer status in part due to a dispute with Canada over its ban on seal fur imports (Halinen, 2016). Regardless, the EU has pressed on in the Arctic and recently increased its focus on the region through a renewal of its 2016 Arctic strategy in 2021 (European Commission, 2021a). It is seeking more normative influence through its policy development on sustainability, peace, and prosperity for the Arctic. Non-state actors such as the EU and others are critical players with substantial normative leadership inside and also outside the Arctic Council. Another relevant example of this is Just Transition Alaska, which places Indigenous place-based knowledge at the forefront of climate leadership in the region (AK, 2021).

### 1.2. Driving a just transition in the Arctic

A just transition in the Arctic is of global importance. The formal

strategies of international institutions demonstrate both its urgency and the multiplicity of issues, from shipping to regional cooperation on communicable disease control (Stokke, 2006; Knecht, 2017). As one example, the Arctic Council has developed adaptation and mitigation strategies on climate induced impacts on the cryosphere, meteorology, ecosystems for the promotion of sustainable livelihoods (AC, 2021). We explore national rather than institutional leadership in line with an observation from the World Wide Fund (WWF, 2021), which states:

"Climate change in the Arctic cannot be changed by action solely within the Arctic – it is a global problem that requires a global solution. However, Arctic countries, especially those with high carbon footprints, should lead the way."

This leads us to our overall research aim: **to investigate which states are more likely to lead a just transition for the Arctic**. Work on state leadership for a fair climate transition in the Arctic is lacking, and we present a first account on the just transition agenda. A single state, sector, business, or community is unlikely, by itself, to achieve a just transition for the entire region. Our objective is to comparatively assess states' likelihood of providing leadership that can help guide other states to achieve the transition. Literature concentrates on case study examples of where nation states have embraced (Cha, 2017; Doorey, 2017; Chapman et al., 2018) or hindered (Healy and Barry, 2017; Barry, 2019; Bainton et al., 2021) a just transition away from fossil fuels. Research is lacking, however, regarding cross-national comparisons of efforts towards a just transition. To fill this gap, we apply the approach found in McCauley and Heffron (2018) on the just transition, which involves the investigation of the distributional, procedural, and restorative dimensions of the global energy transition. It is one framework of the just transition which is especially appropriate for global analysis. Others exist which shed light on local opposition, critical or politicized (Newell and Mulvaney, 2013; Sovacool et al., 2019; Jenkins et al., 2020) framings of just transition, such as the Sámi community and renewable energy projects (Normann, 2021). Applying this framework allows us to develop specific research questions, which build on the existing literature.

The first dimension of this framework is distributional justice, defined as perceived levels of equity across a group or geographical location. Within this agenda, there is an explicit reflection on social and energy dynamics (Schlor, Fischer and Hake, 2013). Research shows that there is significant variation across the Arctic nations on levels of human inequality (Krivitsky et al., 2001). There are differing national accounts of key health (Donaldson et al., 2010), education (Määttä and Uusiaini, 2019), and income inequality (Kirsanova et al., 2020) indicators in each of these nations. Their performance differs also in their record on gender inequality (Rautio et al., 2021). Another set of literature points towards the distributional effects of fossil fuel energy dependency (Morgunova, 2021). The dependency of a state on the import or export of oil, gas or coal can determine the level of a state's support for fossil fuels (Altıparmak, 2021; Salonen, 2021). A third set of distributional inequality is on finance and investment. The dominance of fossil fuels in national economies varies across the sample (Acevedo and Lorca-Susino, 2021). This is not to suggest that fossil fuel dependency is only inherently distributional. It is rather a central energy indicator found in just transition literature (Healy and Barry, 2017) which we investigate from a distributional perspective across the sample states. Some countries are highly dependent on oil and gas, whilst others rely on their financial revenues more than the energy that they provide. This leads us to our first research question: **RQ1 where is a commitment to just transition distributed across our sample?**

Procedural justice in the transition context assures that key decisions are inclusive and meaningfully engage with as wide a range of stakeholders as possible to arrive at a sustainable consensus for decarbonization (McLaren, 2012). The commitment of states differs in the extent to which they adhere to this principle, and across the Arctic states, the

desire to allow multiple voices on issues such as policies affecting Arctic communities varies significantly (James et al., 2020; Knecht, 2017; Leorna et al., 2020; Newton et al., 2016). Another compounding issue is a lack of accountability for both governments and multinational companies regarding their promises to undertake certain actions (Penttilä, 2019; Shapovalova, 2020). Corruption is another challenge to achieving a just transition (Gritsenko and Efimova, 2020) as the rule of law is critical for the delivery of procedural justice in these instances (Natcher et al., 2020). One major dimension of procedural justice is the state's commitments to global climate finance and associated mechanisms (Zamarioli et al., 2021). Nevertheless, scholars have yet to reflect on climate finance and procedural justice for the Arctic, which we combine for the first time in this paper. This brings us to our second research question: **RQ2 how inclusive, fair, and accountable is climate action in our sample states?**

The third component to the just transition framework is restorative justice, which is also referred to in the literature as corrective justice (Moore, 2013). Within the context of the just transition, we equate this dimension with restoring lost jobs in the move away from fossil fuels (Carley and Graff, 2020). Restorative justice puts employment at the forefront of the call for justice (Abraham, 2017). States across the Arctic diverge significantly on their commitments to pursuing renewable energy deployment (Salonen, 2021). With this ambition, we find that job creation is a professed desire for local communities affected by closures of resource extraction sites such as coal power plants and mines (Boute, 2016; Mortensen et al., 2017; Kuyuk et al., 2020). An awareness of the need to develop renewable energy with positive community impacts, such as employment, is key for achieving a just transition in the Arctic. It must include a commitment to fairness (Barry, 2019). This is not to suggest that renewable and fair jobs are naturally correlated, but rather that they are worthy of further investigation in this paper. For instance, the roll-out of employment opportunities needs to be met with living wages and social protection systems. This brings us to our third research question: **RQ3 Which states are most likely to promote renewable energy deployment and fair and green jobs?**

We assess the overall aim and the three research questions through a ranked percentile quantitative comparison of 21 states, of which eight are Arctic Council member states and 13 observer states. Justice scholarship benefits from a rich qualitative history, with multiple case studies evident in the literature pointing towards instances of best practice, e.g. Allen et al. (2019) or, unfortunately, neglect (Healy et al., 2019). We combine the issues, covered above in the generation of research questions, though an energy equity evaluation of Distributive, Procedural and Restorative justice (the DeePeR method, summarised in Table 1). After outlining in more detail our methodology, we present our most important results in the analysis.

The indicators outlined in Table 1 of the DeePeR model originate from the literature as outlined above. These indicators emerged as critical issues for consideration in terms of both energy and equity. They

were also selected based on available global data for the 21 total sample states. We outline our approach to this in section 2.1, and then in more detail on each indicator in sections 2.4.1–2.4.3. This process means that the true breadth of issues involved in the just transition in the Arctic are not fully represented here, which we reflect on in Section 2.5 regarding the limitations of our research. The selection of indicators from existing literature and global data sources allowed for a quantitative assessment of some key issues on the just transition agenda in the Arctic. Future qualitative work in this area would help identify important indicators that should also be included.

## 2. Methods

This section details the primary considerations for the design and implementation of this research. It provides definitional information, reflections on data sourcing and usage, and the key measurement calculations used to answer the three research questions introduced above. We use data structured at a national rather than regional level: as a result, the data necessarily covers the entire territory of the states evaluated, including areas below the Arctic Circle. If more finely scaled data on our indicators became available, future research on how Arctic states' Arctic regions are performing as opposed to their overall territory would be worth examining.

### 2.1. Sources of data, time frame and data availability

We use global open access data from multiple sources in our analysis, as outlined in Table 2. The authors reviewed all measures from two primary global sources, the International Energy Agency (IEA, 2021) which provides energy data, and the World Bank (WB, 2021c, 2021a, 2021b) providing social data. We narrowed down the selection of these measures based on how they relate to our three research questions. Our team used R to clean, pivot, and merge the data based on location and year. We returned to our research questions to identify gaps and seek further relevant global open access measures from other databases. Our approach prioritized comparability across the sample group. This process resulted in integrating relevant data from eight additional sources besides the IEA and WB (Fariss, 2019; ICOS, 2020; ILOSTAT, 2020; IRENA, 2020; NRG, 2020; HBS, 2021; UNDP, 2021; UNSTATS, 2021).

We selected the timeframe of 2011 to 2020 and aggregated our data across this ten-year period. The negotiations on the last major expansion of Arctic Council observer states began in 2011, making it the most relevant starting point for our study. This time frame also allowed for a full comparison of the selected data. We selected measures and sources on this basis. All measures used were complete for the Arctic Council member states. We reported data on Greenland and the Faroe Islands as part of Denmark in line with the data sources. The only incomplete data set was for one observer state, Singapore, in one measure for which data was not available on climate finance pledges or deposits. This is noted in the analysis. Data was available up to and including the end of 2020.

### 2.2. Percentile rank data analysis and visualization

A key challenge in dealing with multiple data sources with natural (e.g. energy production in Terajoules), social (e.g. rule of law indices) and economic (e.g. in millions of US\$) data is how to best compare variable data types. Following the just transition concept means that such an issue is likely to arise as it necessarily involves integrating and analyzing both energy and societal data. Our approach to solving this was the use of percentile rank or rank order, in line with recent literature (Kraipornsak, 2018; Mengova, 2019). Rank order-based analyses are most often used in quantitative surveys where participants rank in order preferences (Maruichi and Abe, 2019). There is a sharp rise in the development of national rank-based indices, which are developed from secondary data (Acharya and Porwal, 2020) or other existing indices to create a meta-index on an issue (Gasser, 2020). We designed our

Table 1

**An Energy and Equity Evaluation of Arctic Council member and observer states using the DeePeR Method:** Distributive, Procedural and Restorative justice are evaluated by ranking the Arctic and observer states based on their performance in selected open-access energy and equity metrics.

|                     | energy                              | equity                                                                                                                        | evaluation |     |
|---------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|------------|-----|
| <b>Distributive</b> | Dependency on fossil fuels          | Health, education, income, gender equality                                                                                    | RANKING    | RQ1 |
| <b>Procedural</b>   | CO2 emissions from energy use       | Finance, accountability, human rights, rule of law, control of corruption, and female representation in ministerial positions |            | RQ2 |
| <b>Restorative</b>  | Deployment and impact of renewables | Unionization, fair wages, social protection, and green jobs                                                                   |            | RQ3 |

**Table 2**

**Indicators of Distributional, Procedural and Restorative Justice:** These are the calculated indicators as represented in Figs. 1–6, with the data from which they were derived. This raw data was obtained from multiple international organisations.

|                | Indicator                                            | Figure | Raw Data                                                                                                                                                                                                                                                | Data Source              |
|----------------|------------------------------------------------------|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| Distributional | Fossil Fuel Energy Dependency (rank percentile)      | 1      | Electricity output (GWh); heat output; imports; exports; production; total final consumption (coal and coal products; natural gas; oil products; oil shale and oil sands; average)                                                                      | IEA 2021                 |
|                | Fossil Fuel Financial Dependency (rank percentile)   | 1      | Fossil Fuel Rents<br>Percentage of GDP                                                                                                                                                                                                                  | WB 2021c                 |
|                | Distributional Inequality (rank percentile)          | 2      | Company Investment<br>Gender Inequality Index                                                                                                                                                                                                           | NRGI 2020<br>UNDP 2021   |
| Procedural     | Procedural Justice (rank percentile)                 | 3      | Coefficient Human Inequality<br>Control Corruption Percentage Rank (average)<br>Percentage of Women in Ministerial Positions (average)<br>Rule of Law Estimate (average)<br>Voice and Accountability Estimate (average)<br>Human Rights Score (average) | WB 2021c                 |
|                | Fossil Fuel CO2 per capita (rank percentile)         | 3, 4   | Coal, Oil and Gas CO2 emissions (average)                                                                                                                                                                                                               | Fariss 2019<br>ICOS 2020 |
|                | Climate Finance Pledge, adjusted for GDP (sum)       | 4      | Climate Finance Pledge/GDP (USD)                                                                                                                                                                                                                        | HBS 2021                 |
| Restorative    | Renewable Jobs per capita (rank percentile)          | 5      | Renewable Jobs                                                                                                                                                                                                                                          | IRENA 2020               |
|                | Fair Jobs (rank percentile)                          | 5      | Collective bargaining coverage rate (%)<br>Trade union density rate (%)<br>Labour share of GDP, comprising wages and social protection (%)                                                                                                              | ILOSTAT 2020             |
|                | Solar/wind/other electricity output per capita (sum) | 5, 6   | Solar/wind/other TJ<br>Electricity output (GWh)                                                                                                                                                                                                         | IEA 2021,<br>WB 2021c    |

approach to compare rank orders rather than create a policy or sector-wide index or a meta index of cross-sector indices.

The process involves identifying cross-source measures relevant for our three research questions. We generated a percentile rank or rank order for each measure. We then combined these in calculations, as set out in Section 2.4 using R software. The basic percentile rank equation is  $R = p/100(n + 1)$ . We created Level of Detail calculations to ensure the analysis returned only the results from the 21 states in our sample, as set out in 2.1. Our next step was to visualize the analysis using software such as Datawrapper (<https://www.datawrapper.de/>) to identify key

observations. As we used rank-order data, we did not explore statistically significant correlations. Our focus was rather to compare the performance of individual states on key measurements of the just transition and in relation to our specific research questions set out in the introduction.

### 2.3. The novelty of this approach

The methodology used in this study has four novel aspects: (i) Data from multiple sources are combined to create novel indicators at a national level; (ii) Global data is used, allowing like-for-like international comparisons, (iii) indicators provide a broad-scope assessment of the just energy transition in Arctic states and observer states; and (iv) data is open-access, and thus freely available, from major international institutions. This allows for a novel just transition assessment at a global level of nation states through the DeePeR framework in the pursuit a fair climate transition in the Arctic.

### 2.4. The DeePeR model: Calculations and key measurements

This research presents the first and novel application of the DeePeR energy equity evaluation of Distributional, Procedural, and Restorative justice. The resulting data set from ten sources outlined in section 2.1 offer a new model of analysis for understanding performance on the just transition.

The DeePeR model seeks to evaluate the transition from fossil fuels to renewable sources of energy, and the drivers of this transition. Our model identifies topics integral to each dimension, as explored in our literature above: distributional [health, income, education, and gender inequalities], procedural [accountability, female representation in decision-making, corruption, finance, rule of law and human rights] and restorative [unionization, fair wage, social protection, and green jobs].

Below, we present a more detailed overview of the key calculations and measurements used in our analysis. We refer to the individual equations and corresponding sources in Appendix 1.

#### 2.4.1. Distributional justice

There are four key calculations for distributional justice within the just transition. We define here *distributional inequality* as the average rank percentile for (1) co-efficient for human inequality, which includes health, education, and income inequality; and (2) an additional gender inequality index. *Fossil fuel energy dependency* is the aggregation of seven IEA measurements regarding oil, gas, and coal. Distributional inequality therefore represents how much a society is tied into fossil fuels, either as an importer, exporter, user or all three. *Fossil fuel financial dependency* is an average ranking of (1) all financially reported project and government-based revenues accrued by companies on oil, coal and gas based on a national basis (2) oil, coal, and gas rents, which means how much a country earns from the production of these commodities, minus production costs. *Fossil fuel dependency* is the aggregation of energy and financial dependency.

#### 2.4.2. Procedural justice

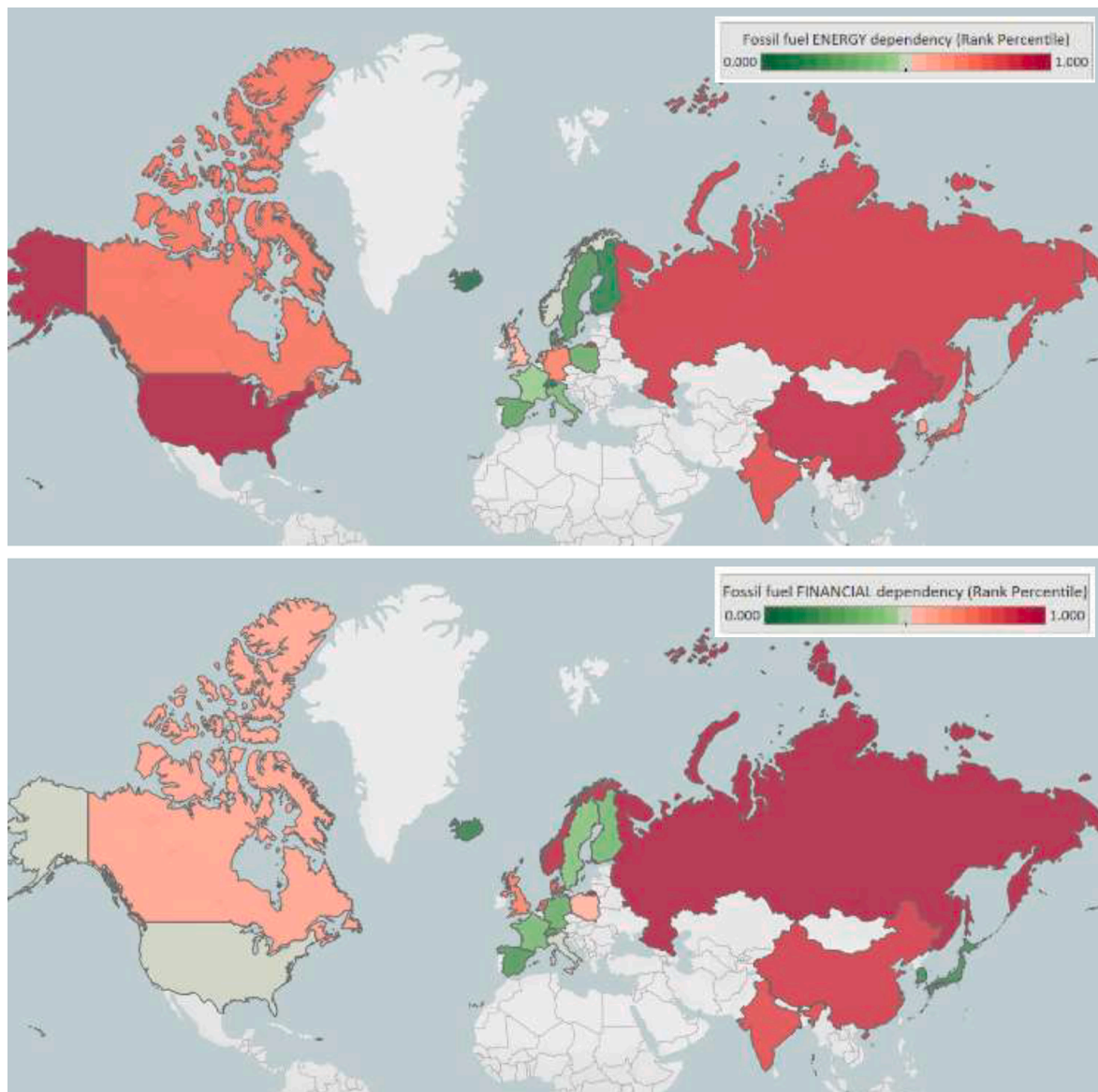
There are two key calculations for procedural justice when dealing with the just transition. We define *procedural inequality* as the average rank percentile for (1) control of corruption, (2) human rights, (3) female representation at ministerial level, (4) voice and accountability and (5) rule of law. In a just transition context, we focused on observations relating to climate change. This meant that we compared these procedural inequality rankings with rank on (6) levels of national CO2 emissions. *Climate finance* was a second key calculation, which was an average percentile rank aggregation of pledged climate finance based on adaptation and mitigation measures, as well as REDD + spending following the Climate Funds Update methodology (HBS 2021).

### 2.4.3. Restorative justice

There are three key calculations for restorative justice that we used for just transition. As noted above, we define *fair jobs* as the average rank percentile for (1) collective bargaining coverage rates, (2) trade union density rates and (3) labour share of GDP, comprising wages and social protection. A core argument of the just transition is to ensure that future non-fossil fuel jobs will be fair to workers. *Renewable jobs per capita* is an average rank percentile calculation, an (1) aggregation of all jobs in the renewable sector divided by (2) population totals. This gives us a sign of how committed a country is to deliver non-fossil fuel jobs. *Modern renewable electricity output* was the third calculation to be used. It isolates electricity output for solar, wind and tidal energy as the fastest growing global renewable energy sources.

### 2.5. Limitations of research

We highlight four key limitations to our research design and implementation. First, in order to maintain comparability, we use international rather than national databases. The level of data availability varies across our study states. We also do not use global measures with partial data whose analysis might have otherwise proven insightful, as significant portions were missing for our sample states. Second, we do not target measures relevant only to the Arctic states, as we instead choose to use globally scaled data that allows analysis of observer states as well. We found some useful sources of data for individual countries, which we will investigate in future studies. Third, we use percentile rank/rank order data. As set out in other studies (Kraipornsak, 2018; Mengova, 2019, 2020), this can limit a deeper analysis of inherent relativity. We try to compensate by closely analyzing and visualizing the



**Fig. 1. Fossil Fuel Energy Dependency and Financial Dependency, rank percentile of Arctic and observer states (average data, 2011–2020):** Green indicates lowest fossil fuel dependency and red indicates highest fossil fuel dependency. Fossil fuel energy dependency is defined as coal, gas, oil and oil shale/sands electricity and heat output, imports and exports, production, and total consumption (data from IEA 2021). Fossil fuel financial dependency is defined as the percentage of fossil fuel rents by GDP (data from WB 2021) and company investment in USD (data from NRG 2020). The upper panel shows that the states with lowest fossil fuel energy dependency are Iceland, Switzerland and Finland, while those with the highest are the U.S., China and Russia. The lower panel shows that the states with lowest fossil fuel financial dependency are Iceland, Japan and South Korea; while those with the highest are Russia, Norway and China. Rank percentile data is listed in Supplementary Table 1. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

ranks in the figures below. Fourth and lastly, we do not examine variables at the level of Indigenous Peoples' organizations since this study is based on data at state level. In future studies of the Arctic, we encourage a quantitative analysis of data focusing on Indigenous communities and on measures deemed important both to and by them.

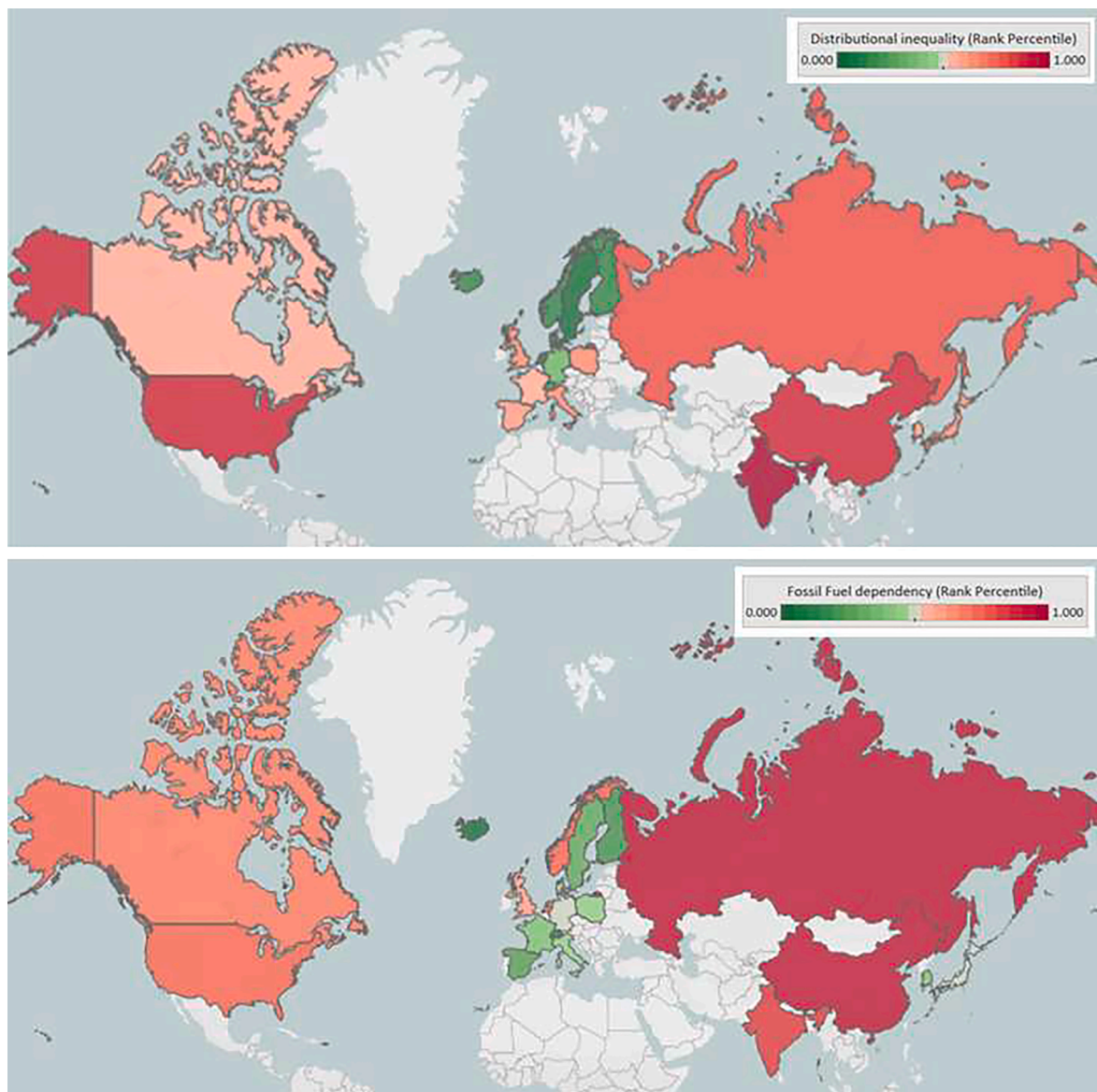
### 3. Results

We present below the key observations from our data analysis in line with our three research questions derived from the literature on just transition. Rank percentile is the dominant measurement, as outlined above, with a focus on our core sample of the Arctic states and formal observer nations. We note and justify when we deviate from this.

#### 3.1. Distributional justice and fossil fuel dependency

One would expect dependency on fossil fuels to correlate with a weaker commitment to transition to renewables (Le Billon and Kristoffersen, 2020). We define fossil fuel dependency as both the use of and reliance upon *imported and exported natural resources*, as well as the *financial resources derived from these activities*. The variation in fossil fuel energy dependency and financial dependency across Arctic and observer states can be seen in Fig. 1. The distribution of fossil fuel dependency across the sample states in focus is a key concern.

For energy dependency, the upper panel of Fig. 1 shows a clear divide between the east (Asia), west (North America) and centre (Europe). The east and west sections represent the most fossil fuel energy dependent states (U.S., China, Russia, India, Japan and Canada ranked top), while European states, with the exception of Germany and the Netherlands, consistently exhibit the lowest-ranked fossil fuel energy dependency.



**Fig. 2.** Distributional Inequality, rank percentile of Arctic and observer states, compared with overall fossil fuel dependency (average data, 2011–2020): Green indicates lowest and red indicates highest distributional inequality, as defined by gender inequality and human inequality (education, income, and health) data (sourced from UNDP 2021). This figure shows that the states with lowest distributional inequality (green, starting from lowest ranked) are Sweden, Denmark, and Finland; while those with the highest are India, U.S. and China. With regards overall fossil fuel dependency, Russia, China and India rank highest, and Iceland, Switzerland and Finland lowest. Rank percentile data is listed in Supplementary Table 1. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

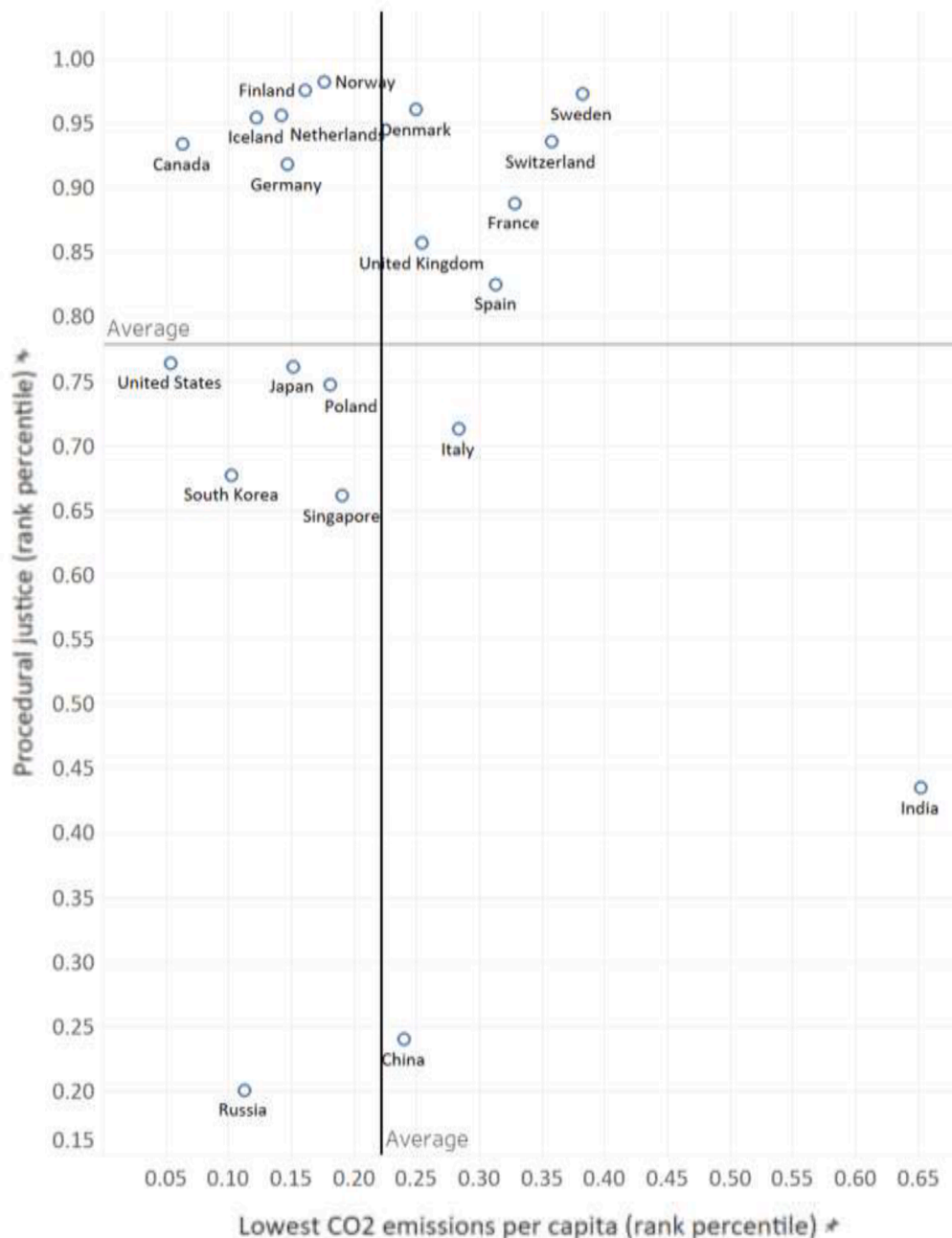
Fossil fuel financial dependency (lower panel Fig. 1) is less regionally concentrated, with Russia, Norway, China and India comprising the four states most financially dependent on fossil fuels, while Iceland, Japan and South Korea are the least financially dependent.

For a comprehensive spatial picture of the sample to emerge, we need to view the average rank in energy and financial dependency on fossil fuels alongside data on distributional inequalities, which we move to next in Fig. 2.

Fig. 2 combines our key measures on distributional inequality with an aggregated rank calculation based on fossil fuel energy and financial dependency. The ratio of distributional inequality to overall fossil fuel dependency highlights three discrete groups of states; 1) Iceland and Spain have low fossil fuel dependency but proportionally higher distributional inequality, 2) Norway, Sweden, the Netherlands and Denmark have low distributional inequality but proportionally higher overall fossil fuel dependency, and 3) the rest of the states for which the ranks

are proportionally similar for both measures. Specifically, Russia, China and India rank highest for overall fossil fuel dependency, while Iceland, Switzerland and Finland rank the lowest. For distributional inequality, the top-ranking states were India, China and the US, while the three lowest were Sweden and Denmark with Norway and Finland sharing third place.

In response to RQ 1, the level of potential commitment (i.e. least fossil fuel dependency and lowest levels of distributional inequality) to a just transition is most observable in the geographic centre of our sample – in other words, Europe. While the financial aspects of fossil fuel dependency are often overlooked, they are equally important in estimating a state's commitment to a transition away from fossil fuels as an energy source. The states located in the centre of Fig. 1 exhibit the lowest fossil fuel energy dependency *and* financial dependency. Consequently, we may find higher commitments to a just transition within Europe as opposed to North America and Asia. We move onto explore this in



**Fig. 3. Global ranking of Arctic and observer states for Procedural Justice and lowest Fossil Fuel CO2 Emissions per capita, average data 2011–2020:** Procedural Justice rank percentile is a composite of (i) Control of corruption, (ii) Human Rights Score (data from Fariss 2019) (iii) Percentage of women in ministerial roles, (iv) Rule of Law Estimate and (v) Voice and Accountability Estimate (data from WB2021c). CO2 emissions per capita is defined by average coal, oil, and gas CO2 emissions. Procedural Justice score and lowest CO2 emissions ranking are based on global comparisons of a set of 206 countries for which data was available, not just a comparison between the 21 Arctic and observer states themselves as is the case for all other data figures. This figure shows that Russia and China have the lowest rank percentile Procedural Justice score among the Arctic and observer states, while Norway and Finland the highest. India has the lowest CO2 emissions per capita, followed by Sweden, while the U.S. and Canada have the highest.

procedural and restorative justice.

### 3.2. Procedural justice, CO2 fossil fuel emissions and climate change action

A commitment to procedural justice is essential for the delivery of a just transition (McLaren, 2012). To follow the just transition framework, we plot in Fig. 3 a comparison between *global* ranking in procedural justice and a global ranking of states with the *lowest* fossil fuels CO2 emissions per capita. This shows where the existing commitment towards a low carbon approach to procedural justice is observable.

The first conclusion is that most of the Arctic and Observer states are in the top 35% of those countries ranked highest for procedural justice, on a global scale. Three notable outliers are Russia, China, and India. The second conclusion is that most of the sample states are in the bottom 35% of those with the lowest CO2 emissions per capita, meaning they are comparatively high CO2 emitters per capita. This presents a mixed picture where a commitment towards procedural justice is clear among the sample group but not to a commitment toward CO2 emissions reductions. Those states that are best placed to promote a just transition from a procedural perspective can be found the top right-hand quartile of Fig. 3. These are European states, including two Arctic Council Member states (Denmark and Sweden). We move on to reflect on the differences between the sample group in more detail.

We include another dimension, climate finance, to investigate the depth of commitment to mitigating climate change impacts (Fig. 4). Our measure of climate finance is based on HBS (2021) data divided by GDP per capita. Climate finance data from Singapore was unavailable, so Singapore is not represented in Fig. 4.

A first conclusion is that, generally, countries with the highest CO2 emissions from fossil fuels have pledged the lowest amount of climate finance under the United Nations Framework Convention on Climate Change (UNFCCC) process. These states are represented by the smaller red boxes located on the bottom right of Fig. 4. In this figure, the smallest boxes represent the least contributing nations, and the colour gradient is an indicator of CO2 emissions. The largest financial contributors are in order of size of rectangle, starting from the top left and moving towards the bottom right. We identify Norway and Sweden as

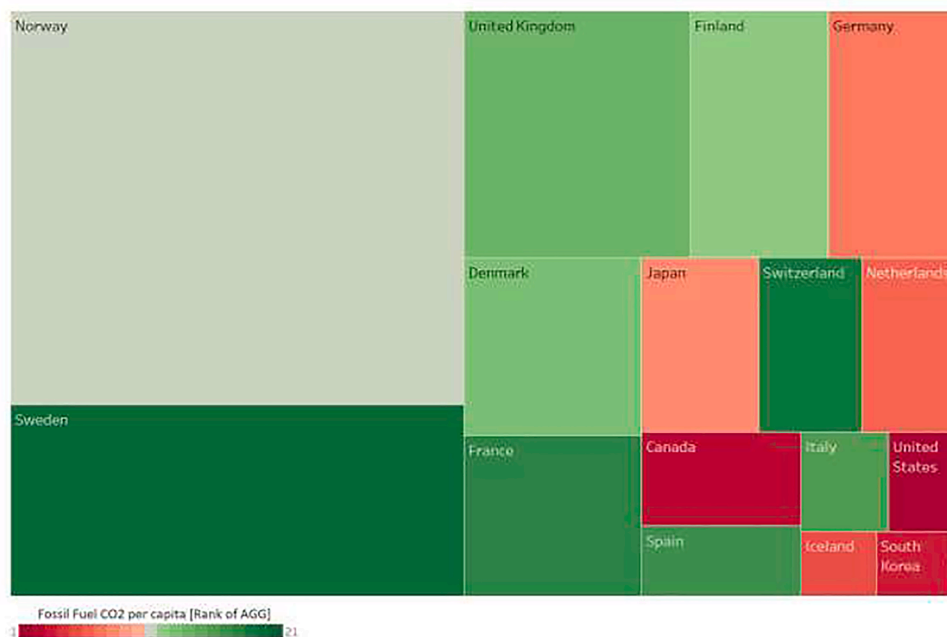
the two primary climate financiers. Norway, with mid-ranking levels of CO2 emissions among the Arctic and observer states, is by far the dominant contributor to climate finance among our sample group. Sweden emits notably less CO2, being the second-lowest emitter among all of the Arctic and observer states together, but is the second-largest contributor to climate finance. In stark contrast, Russia is a heavy CO2 polluter and has also pledged the smallest amount to climate financing under the UNFCCC program.

In response to RQ 2, the overriding impression is that formal Arctic and observer states represent, globally, some of the most progressive states, contrasting with their collectively high ranking in global CO2 emissions per capita. In fact, the world's top seven CO2 emitters per capita are all Arctic Council Member States or Observers. Nevertheless, our findings show the importance of combining both climate change adaptation and mitigation with justice measurements to produce a comprehensive picture of the procedural dimensions of the just transition. The inclusion of climate finance adds to this picture, showing the level to which states are seeking to rebalance the mismatch between positive procedural justice rankings and negative CO2 emissions rankings. At this early stage of global climate financing, we find these results to be disappointing, pointing to a lack of commitment from Arctic Council member and observer states to financing climate action. However, we found notable exceptions among European countries. We now move to consider the restorative justice rankings for the 21 states in our sample.

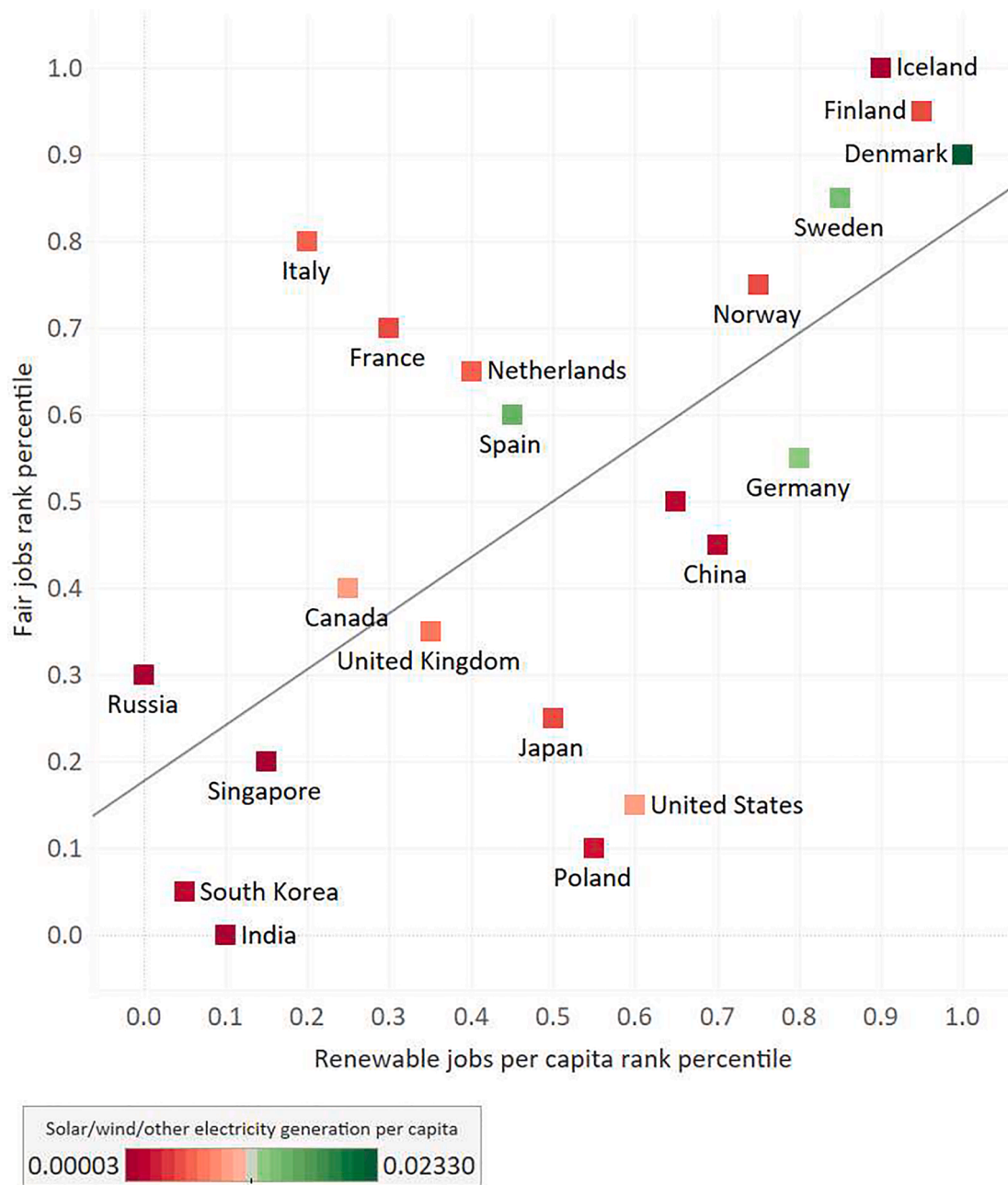
### 3.3. Restorative justice, fair and green jobs

Employment has been a key feature of just transition since its inception (Carley and Graff, 2020). We assess below where our sample countries rank on fair jobs and renewable jobs (Fig. 5).

Our first observation is that a high ranking of fair jobs tends to correlate with a high ranking of renewable jobs. Furthermore, the higher the rank in fair jobs and renewable jobs, the more pronounced this correlation appears to be. The Nordic countries (Norway, Sweden, Denmark, Finland, and Iceland) appear to be taking the lead in this area. The correlation between fair and renewable jobs scores becomes less apparent at the lower end of the ranking scale. Russia is ranked last in



**Fig. 4. Climate Finance Pledges vs Fossil Fuel CO2 Emissions per capita, rank percentile of Arctic and Observer states, average 2011–2020:** Box size indicates the scale of climate finance pledges in proportion to gross domestic product (data from HBS 2021), the largest boxes indicating the largest climate finance pledges. Box colour indicates CO2 emissions per capita, with green signifying the lowest and red the highest CO2 emissions per capita (as defined by average coal, oil and gas CO2 emissions; data from ICOS 2020, previously shown in Fig. 3). The four small unlabelled boxes in the bottom right corner are (from top to bottom) Russia, Poland, India, and China. This figure shows that Norway has pledged the most climate finance and China the least. India is ranked lowest for fossil fuel CO2 emissions per capita, and USA ranked highest. Nine out of thirteen European states are ranked among the lowest CO2 producers (i.e. coloured green), with Norway occupying a mid-ranking position. The seven highest climate finance pledges are made by European states. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)



**Fig. 5. Fair Jobs rank percentile vs Renewable Jobs rank percentile vs Total Renewable Electricity Generation per capita of Arctic and observer states, average 2011–2020:** Fair Jobs is a composite of collective bargaining coverage, trade union density (data from [ILOSTAT 2020](#)) and labour share of gross domestic product (in the form of wages and social protection; data from [UNDP 2021](#)) measures. Data on renewable jobs per capita was obtained from [IRENA \(2020\)](#). Total Renewable Electricity Generation per capita is a sum of solar, wind and tidal (as defined by [IEA 2021](#)) electricity output (data from [IEA 2021](#); [WB2021c](#)). This figure shows that Iceland, Finland, and Denmark score highest on Fair Jobs and Renewable Jobs indicators, while India and South Korea score lowest. Denmark has the highest Total Renewable Electricity output of the Arctic and observer states, while Russia has the smallest amount.

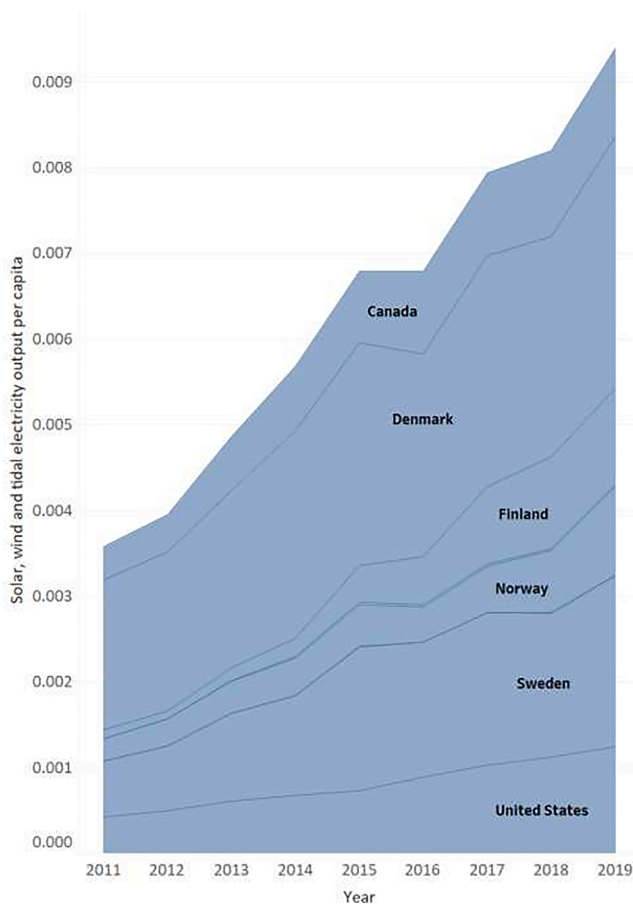
the sample group for renewable jobs but is more highly ranked for a commitment towards fairer jobs. The inverse is true for India. We also see no strong correlation to a commitment in modern renewables driven by solar, wind and tidal energy (shown by red-green colour gradient). The ranking for renewable jobs per capita includes all types of modern and traditional renewable such as hydroelectricity. We move on to consider this aspect in more detail for the Arctic states.

A just transition involves the development of fair and green jobs. There is a need to consider the performances of our sample group on modern renewable electricity output. While [Fig. 5](#) showed renewable energy generation in all 21 Arctic and Observer states, [Fig. 6](#) focuses only on data relating to the eight Arctic states. This figure shows the

change in renewable electricity output of the eight formal Arctic states over the timeframe of 2011–2019. In this instance, the analysis is not presented according to rank percentile, but rather electricity output per capita.

[Fig. 6](#) reveals that Russia makes the least progress, while Denmark leads the way in modern renewable energy development for the formal Arctic states. This contrasts with the modest advancements in Norway because of its existing commitment to more traditional forms of renewable energy, i.e., large-scale hydropower, which Iceland also shares. Overall, there is a year-on-year increase in modern renewable electricity output across the formal Arctic states, except for Russia.

Our analysis shows that a commitment to fair jobs is connected to



**Fig. 6. Solar, wind and tidal electricity output (GWh) per capita in Arctic states from 2011 to 2019:** This figure shows the overall increase in renewable energy output in the Arctic region, and its main contributors. Denmark is the main contributor (as determined by area under the curve), closely followed by Sweden. Russia and Iceland make a negligible contribution to overall Arctic solar and wind electricity output. It should be noted that this data does not include hydropower electricity generation.

progress in renewable job generation. A combined approach to both fairer processes in employment with renewable energy technology deployment offers the best chances to deliver restorative justice in employment. As the world commits to reducing fossil fuel extraction, there is an urgent need for societies to replace its associated employment structures with renewable energy jobs in combination with a guarantee to fairer employment processes.

In response to RQ 3, we observe a more pronounced dedication to this process in lower fossil fuel CO<sub>2</sub> emitting nations, namely Sweden, Denmark, Finland, and Iceland. There are some exceptions in the cases of Norway, Germany, and the Netherlands. When considering the other three Arctic Council member states, the picture is less positive. Canada, Russia, and the United States – the three countries possessing the largest amounts of territory north of the Arctic Circle – show a slower progression in committing to fair and renewable jobs. In a similar observation to our other justice dimensions, the top 30% in rankings (among the 21 sample states) in both fair jobs and renewable jobs are European states.

#### 4. Discussion and conclusion

Our goal in this paper was to investigate which states are more likely to contribute to a just transition for the Arctic. We took an approach which followed McCauley and Heffron (2018) which was an explicit choice as it provided one framework to investigate global level national

performance. In this paper, we were unable to assess local or more critical understandings of just transition as mentioned in the introduction. We locate this task within the importance of normative leadership and the novelty of assessing just transition from the perspective of national leadership on a fair climate transition. The norms, values, and interests of active stakeholders matter, regardless of whether or not they possess territory in the region in question, for they can re-shape the culture, process, and outputs of an external group (Peng and Kim, 2020). For the climate transition, it is already well established that state leadership exerts a major normative influence on the composition and process of multilateral efforts (Falkner, 2019; Wunderlich, 2020; von Lucke et al., 2021). We reflect on the implications of our novel analysis for making polluters more financially accountable, pressing states to deliver fair and green employment. We also consider the potential for normative leadership not by one state but rather the EU in light of its geopolitical and economic power and the fact two of its member states with Arctic territory, Sweden and Denmark, are already leading aspects of the just transition compared to other Arctic Council Member and Observer states, as revealed by our analysis.

##### 4.1. Arctic polluters need to pledge more.

In view of their status as stakeholders, Arctic Council member states and observer states alike should be held accountable to the highest standards. More analysis, such as in this paper, on their climate performance is needed to scrutinize whether they are living up to their varying commitments. Norway, Sweden, UK, Denmark, France and Finland are contributing more to the UNFCCC process, as illustrated by Fig. 4. This figure also shows the crippling disconnect between CO<sub>2</sub> emissions per capita and the amount of money pledged through this process. None of these nations are pledging enough. Those that are pledging higher amounts tend to be states with lower CO<sub>2</sub> emissions. This needs to change. A just transition in the Arctic requires the highest-polluting nations to recognise the impact of their own CO<sub>2</sub> emissions. That being said, it is admittedly debatable whether pledges to the official UNFCCC process are sufficient evidence of a commitment to a just transition, especially considering that one of the highest contributors, Norway, remains one of the world's largest fossil fuel producers.

Recent work on climate financing shows the inadequacies and procedural injustice of global climate finance processes and accounting (Bhandary et al., 2021; Bracking and Leffel, 2021; Roberts et al., 2021; Zamarioli et al., 2021). With regard to data issues, while we considered using OECD data for our analysis, the timeframe and country coverage did not meet our requirements. The OECD also admit to “significant inconsistencies in terms of methodologies, categorizations and definitions adopted across countries” (OECD, 2018). This is not to discredit their efforts. It is to support observations that there is simply no single reputable source of information. There is also a frustrating global failure to agree on a key financial mechanism. We support remarks by Roberts et al. (2021, p. 26) that “clear rules for what counts as climate finance need to be agreed”. Our evidence-based conclusions reinforce that there is not only a disconnect between developing countries paying a fair share, as identified by Zamarioli et al. (2021), but also between climate finance and CO<sub>2</sub> emissions.

Just transition focuses on procedural justice within the limited, albeit important, prism of how a worker can influence their own employment (Thomas, 2021) or how a developer engages with a community (Sowman and Sunde, 2021). Procedural justice on a global scale must involve a broader focus. Financial investments to clean up a state's carbon emissions are a key process internationally for realizing a just transition. The procedural dimension is ensuring an international mechanism where each state signs up to its fair share of recompense. For the Arctic – a region particularly sensitive to global climate change – this is a leading part of the broader procedural justice picture depicted in Fig. 3. The relatively high performance of most of the sample states on a global scale (Fig. 3) shows that we must expect the highest forms of procedural

justice for the Arctic region, especially with regard to financing, given the especially sensitive and cascading nature of climate impacts there.

#### 4.2. Delivering new jobs that are fair, not only green

A just transition away from fossil fuels requires, at the most basic level, a like-for-like replacement of employment for affected communities from the transition away from fossil fuels (Abraham, 2017). A first step is to increase renewable energy consumption to maximize demand. Fig. 6 shows there is overall progress in renewable energy generation, primarily in solar and wind capacity, across the Arctic. But the pace of renewable energy expansion remains insufficient. The Arctic is set to be dominated by fossil fuel production for the foreseeable future, with activity concentrated in Norway and Russia. Greater investment in renewables is required in Arctic states, including in both petroleum-producing states and those with large carbon-intensive sectors such as mining, before an employment revolution can be realized. Our analysis implies that, when such a revolution takes place, we should consider not simply the energy source but also future employment structures.

Employment is more than financial recompense. It shapes livelihoods and communities and embeds cultural norms and values. We limit our analysis to inferring conclusions from normative leadership on pursuing both green and fair jobs. Fig. 5 shows the variable records in the sample of achieving both objectives, with Iceland, Finland and Denmark leading the way. Such a commitment means increasing considering the types, conditions and skills required for such jobs, whilst ensuring a fair meaningful wage. The renewable revolution is an opportunity to imagine a better future rather than replicate the poor conditions of the past. Recent research points to the scale of the challenge for the Arctic region, whose economy has relied on export-oriented natural resource extraction for five hundred years in places, and heavy industry throughout the twentieth century (Berman and Orttung, 2020; Korneeva and Simonova, 2020; Tsvetkova, 2021). Berman and Orttung (2020) argue that the application of international measurements and standards is especially problematic. In their assessment of work in the Arctic, they comment that, “although Arctic cities confront many of the same challenges as cities worldwide, they also face challenges associated with their unique geography, climate, economies, and histories.” Normative leadership on green and fair jobs is thus only part of the solution to a complex problem.

#### 4.3. The EU needs to show leadership on just transition for the Arctic, from the inside and out.

Our analysis points to the need for the EU, a major geopolitical and economic actor and unofficial deferred observer in the Arctic Council, to step up and help lead the just transition. In 2019, temporary Finnish Prime Minister Antti Rinne commented, “(t)here should be more EU in the Arctic and more Arctic in the EU, because the EU has a lot to offer the region” (VFK, 2019). Our analysis confirms that this to be especially true on just transition. Figs. 1, 2 and 3 above show that, out of all the Arctic Council Member and Observer states, countries within the EU provide the most potential for just transition leadership. The EU renewed its 2016 Arctic Strategy in 2021 (European Commission, 2021a). Its renewal may prove crucial to the pursuit of a just transition in the Arctic – at least, one that is ‘just’ according to the EU’s norms. The European Parliament recently stated in a report called ‘(A) Balanced Arctic Policy for the EU’ that “next generation of voters and questions of intergenerational equity (justice and fairness between generations) will become more prominent” (European Parliament, 2020). The EU must consider its normative power in driving both a climate transition and higher levels of equality. The heightening of interest in the region from countries south of the Arctic Circle means that a diversification of values and norms is likely. This may challenge the ability to agree upon a single set of norms to underpin a common Arctic strategy, which is all the more reason that strong leadership is required.

We must stress certain concerns regarding the EU’s potential to offer

leadership on just transition. The performance of the EU on the just transition agenda, in isolation, is debatable. It is the most significant multi-nation-state region of the world to commit to a just transition objective through the EU Green Deal (European Commission, 2021b). This includes a sophisticated financial mechanism referred to as the Just Transition Platform (European Parliament, 2021). This is commendable. And, while it is rather narrowly focused on coal-producing or -mining regions of the EU (Voicu-Dorobanțu et al., 2021), such a focus could in fact be relevant to the Arctic, where numerous settlements are dependent on mining, coal included. Nevertheless, the Just Transition Platform’s design is questionable, with a unidimensional focus on skills and jobs replacements in these specific regions. Its commitment must go further and wider than this if the EU is to positively drive similar endeavours in the Arctic.

Many Arctic Indigenous Peoples accuse the EU of “green colonialism.” The Tråante Declaration published in 2017 by the Saami Council, the organization which represents Saami living in Finland, Russia, Norway, and Sweden, specifically criticized “green colonialism,” underscoring, “Intrusion, such as mines, hydropower, wind power and other ‘green energy’ and infrastructure steals land from Sápmi and thus causes the Saami living space to decrease” (Saami Council, 2017, p. 3). Conflicts over wind power in southern Saepmi (Norway) attest to the strident opposition many Sami have to projects that would be seen as “green” in more southern metropolises (Normann, 2021).

Representing another example of “green colonialism,” in 2009, the EU enacted its seal regime, a legislative framework, in response to “public moral concerns about animal welfare aspects of seal hunt” (European Commission, 2016). The ban has exerted a devastating economic impact on Inuit communities in Canada and Greenland reliant on exporting fur (Hennig, 2018). An exemption made for Inuit products in 2015 did little to help the situation, as the market had already been “destroyed,” according to the Government of the Northwest Territories in Canada (European Commission, 2020). As mentioned earlier, the EU’s continued seal regime is one reason why a decision on its Arctic Council observer application remains deferred.

Yet while EU policy is problematic, the 27-country economic and political union can still lead within the Arctic on the environment and justice. ‘Normative Power Europe’ (Manners, 2002) is a thesis that suggests regulatory cultures, values and norms underpinning the EU’s approach can be exported to new external settings, such as the Arctic region. As the then incoming European Commission President noted in 2019, “Europe must also learn the language of power... and be more strategic with a view to Europe’s external interests” (Carrell, 2019). At the same time, the EU – regardless of whether it is eventually approved as an Observer – should also realize that a diverse array of interests exists within the Arctic. What may appear sustainable or humane to Brussels, such as green energy or banning seal fur, may harm Arctic Indigenous livelihoods. In working towards the just transition, the EU can show normative leadership by first and foremost recognizing the diversity of norms and beliefs that exist not only among Arctic Council member states and observers, but within and between Arctic communities, too. While our research has demonstrated that certain states or multilateral organizations like the EU may be more likely than others to lead the just transition, for it to be truly sustainable, it must respect and uphold the values of those living in the Arctic. In order to achieve this aim, we encourage future work to investigate local, critical, and more co-produced understandings of the just transition in the Arctic to build further case study insights in pursuit of a more comprehensive and inclusive view.

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#### CRediT authorship contribution statement

**Darren McCauley:** Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Visualization, Supervision, Project administration. **Kerry A. Pettigrew:** Methodology, Software, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Visualization. **Mia M. Bennett:** Writing – original draft, Writing – review & editing. **Iain Todd:** Conceptualization, Writing – review & editing. **Corine Wood-Donnelly:** Writing – review & editing.

#### Declaration of Competing Interest

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

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#### Appendix A. Supplementary data

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