Implications of climate policy on energy poverty

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OUTLINE

0. **Executive summary**
1. **Introduction**
2. **The link between climate policy stringency and energy prices**
3. **Implications of energy prices spike on affordability**
4. **Energy access global picture: Implications of climate policy on energy justice**
5. **Conclusion and policy implications**

EXECUTIVE SUMMARY

This article examines the complex issue of energy poverty and its various dimensions, including energy access and affordability. It explores the challenges of addressing energy poverty and the trade-off that may exist between energy poverty and climate change policy.

We first look at the impact of climate policies on energy affordability and access in Europe, where we use the climate policy stringency index to analyze its correlation with electricity prices. The results show a strong positive correlation between the two variables, suggesting that countries with more stringent climate policies tend to have higher electricity prices. Case studies from various EU countries indicate that the increase in electricity prices has rendered some 5% to 40% of country populations under energy poverty, while alleviation policies are far from addressing the issue.

The analysis is then expanded to the context of developing nations, where governments' ability to enact alleviation and redistributive policies is limited, and energy infrastructure is far from adequate, with a significant portion of the population lacking access, both of which lead to worsening energy poverty. These twin risks can pose severe consequences for people's health, education, and economic opportunities in these nations.

The article concludes with policy insights and feasible actions to address energy affordability and access. It also highlights the importance of considering the interplay between climate actions and energy affordability and the potential implications for developing countries with limited public revenues and infrastructure capacity. More importantly, it highlights the importance of ensuring that the themes of energy poverty (i.e., affordability and access) are intrinsically interwoven in the design of climate policies, climate transition strategies, and climate ambitions, especially in developing nations.

Overall, to achieve success in addressing climate change and energy poverty, several factors are crucial, such as political will, international cooperation, institutional capacity, and financial resources. An integrated approach is necessary to achieve both equity and climate targets by considering the complex interplay of different factors and stakeholders. The Paris Agreement principles prioritize national circumstances, which means that developing countries should not have to choose between their local development agendas, such as addressing energy poverty, and global climate action. Developing countries should still contribute to international efforts to achieve net-zero emissions, but it should not come at the expense of their local development agendas.

1. INTRODUCTION

The concept of energy poverty can be defined as the inability of households to access adequate energy for essential services, including cooking, heating, cooling, and lighting (Belaïd 2018, 2022). Energy poverty has several dimensions, including energy access, adequacy, convenience, reliability, and affordability, as defined by Welsch and Biermann (2017). While more countries are beginning to recognize energy poverty in their policies and legislations, many policymakers struggle to adequately address the complex nature of this issue.

Energy poverty remains a vexing issue in many countries, particularly low-income countries. According to IEA's Energy Access Outlook in 2021 (IEA, 2021), roughly 840 million people globally do not have access to electricity, and 2.9 billion people rely on traditional solid fuels such as charcoal and wood for cooking and heating. Multiple studies have documented that energy poverty is associated with severe physical and mental health consequences (Hernández and Siegel 2019). Ensuring energy prices at affordable levels, raising investment in infrastructure, and widening redistributive government policies are only some potential ways to fight energy poverty. However, many developing countries struggle with balancing the burning needs of eradicating energy poverty and the priorities of meeting the climate change agenda. That trade-off may put many more under the energy poverty line if a just agenda is not made the focus of the current energy transitions.

As countries strive to meet their nationally determined contributions (NDCs) and address climate change, they are implementing more ambitious policies. However, these policies have raised concerns about energy poverty, leading to rising energy prices worldwide, partly due to more stringent environmental regulations. This has also created challenges for those struggling with affordability. In this Global Stocktake, we aim to provide insights into the relationship between climate policies and energy prices, as well as the capacity of redistributive government policies to address the issues. Within the context of this process, these policy recommendations can support countries in designing ambitious climate policies that also keep these important social variables in mind.

Despite some research on energy poverty and its impact on well-being and inequality in both developed and developing countries, there is still much to explore. Our study focuses on Europe to investigate the effects of climate policies on energy affordability and access given the extensive climate policy agenda in Europe and the availability of relevant data. To measure the size and scope of climate policies, we utilize the climate policy stringency index (Kruse et al., 2022) and analyze its correlation with electricity prices in Europe.

Our descriptive analysis reveals a strong and statistically significant positive correlation between the two variables across both the temporal and cross-sectional dimensions. This suggests that the positive dynamic trend between the variables is not only present but also that countries with more stringent policies tend to have higher electricity prices in any given year. Higher electricity prices limit citizens' access to affordable energy, especially for low-income earners, which in turn affects their energy access (United Nations, 2021). To minimize this effect, many EU countries offer redistributive policies, such as energy poverty alleviation policies. However, studies indicate that the impact of these policies is relatively limited, and many EU countries still have high rates of energy poverty, ranging from 5% to 40% of their populations (Mara and Matthias, 2021; Belaïd, 2022).

Energy poverty in many developing countries is already a significant issue. Implementing more stringent climate policies in these countries without addressing affordability and energy infrastructure concerns exacerbates the problem of energy poverty. In addition to lacking well-established energy infrastructure, many developing countries also have limited public revenues and capacity to support low-income households, making it difficult to alleviate energy poverty through policy interventions. Thus, the effectiveness and feasibility of energy poverty reduction policies, which have delivered limited success even in developed countries, are expected to be weaker in the context of developing countries. Moreover, it is essential to carefully consider the particular context and challenges facing different communities and develop tailored solutions that consider the social, economic, and technical factors in each context. For example, while renewable may help address energy poverty in specific contexts, it is not a one-size-fits-all solution.

The article is structured as follows: Section 2 outlines the foundation and principles of energy affordability and its linkage to climate policies. Section 3 discusses the implications of climate policy on electricity prices in Europe. Drawing from the European experience, Section 4 reflects on the global interplay between climate actions and energy poverty. Finally, Section 5 draws conclusions and suggests possible measures.

2. THE LINK BETWEEN CLIMATE POLICY STRINGENCY AND ENERGY PRICE

Recent studies have highlighted the fact that transitions can create both winners and losers, and it is vital to consider the inclusive and distributive aspects of the transition (Carley and Konisky, 2020).

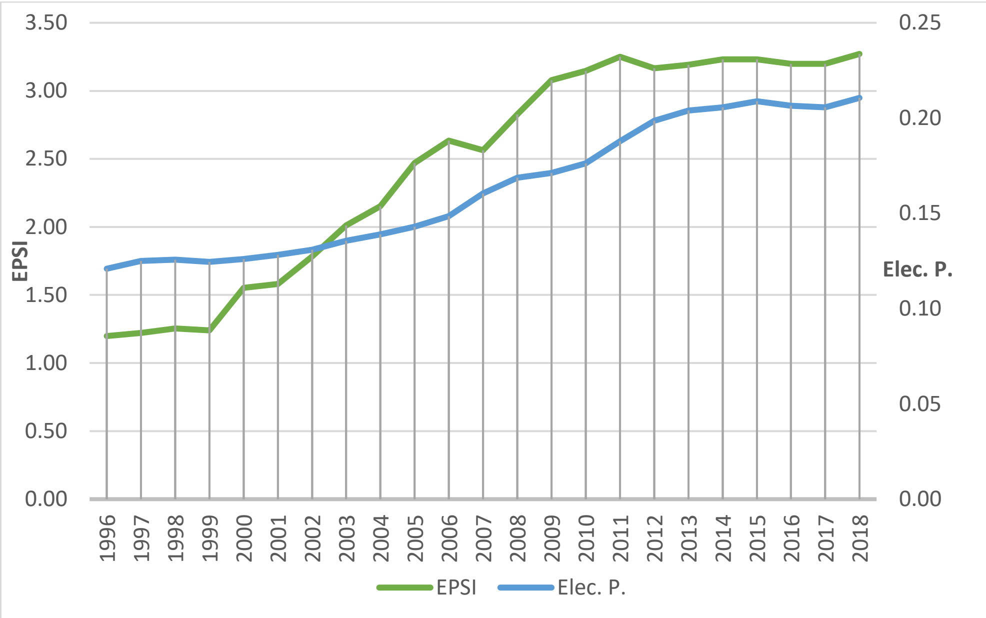
Climate change policies levy an economic cost on goods, particularly energy, and can pose a considerable risk to lower-income populations. With falling incomes, rising poverty, and glaring inequalities, the goal of ensuring affordable and sufficient energy for all become even more imperative.

High energy prices will disproportionately affect different income segments of society. This will trigger energy affordability issues. We use the EU context to showcase the interplay between climate policy stringency and electricity prices. Europe is a good case study to illustrate the unintended effects of climate policy on energy poverty due to its early adoption of climate policy, diverse energy mix, high energy prices, and a large spectrum of policy solutions. Investigating the impact of climate policy on energy poverty in Europe offers valuable insight for policymakers to design and implement equitable and inclusive climate policies that do not exacerbate energy poverty.

Over the last three decades, we observe a strong association between the climate policy stringency index and electricty prices (Fig. 1). When considering cross-country differences and overtime variations, the positive relationship between the climate policy stringency index and electricity price in Europe becomes even more evident (Fig. 2). Data is available for 22 EU countries, including the UK.[1]

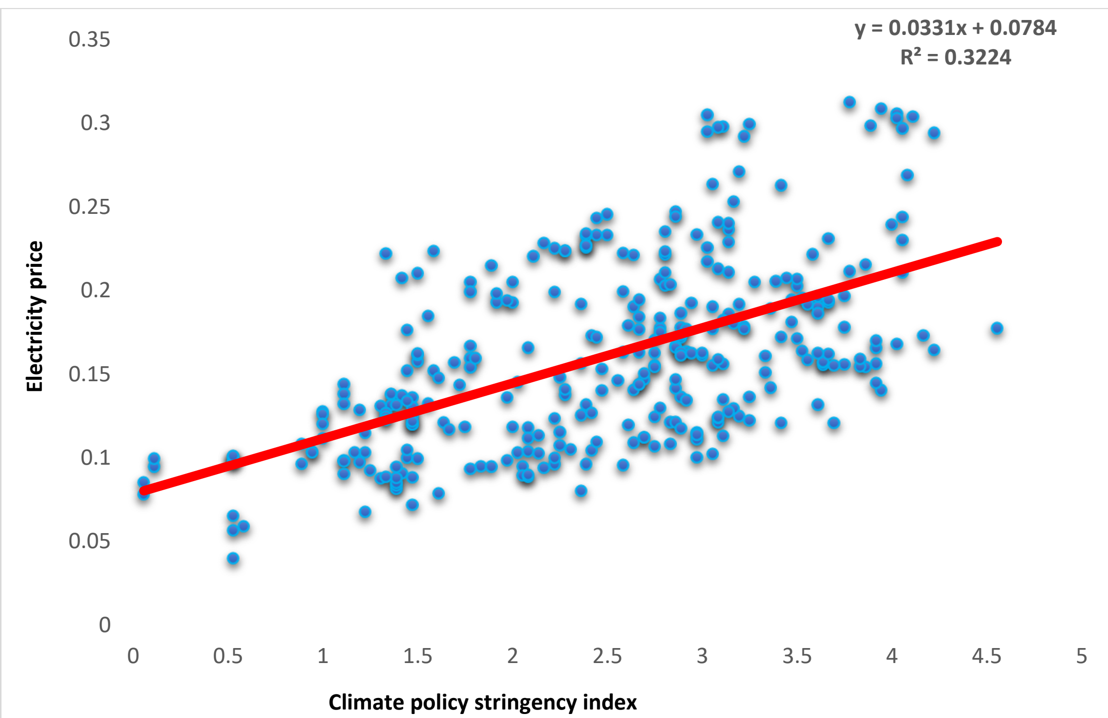
[1] The 22 EU countries include Austra, Belgium, Czechia, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom.

Figure 1: Estimates of the climate policy stringency index (CPSI) and electricity prices (Elec. P.) in Europe



Source: Authors' construction. Note: CPSI is the average climate policy stringency index, and Elec.P. is the average electricity price in euros per kWh.

Figure 2: Association between the climate policy stringency index and electricity prices in Europe (1996-2018).



Source: Authors' construction

Energy price increases can be attributed to a variety of factors affecting demand and supply conditions, such as geopolitical events. The rise in energy prices can also be attributed to stringent climate policies that are motivated by the global climate change agenda, and previous research has shown that climate policies that are strict in nature can lead to energy price increases, particularly in the short term (Fezzi and Derek, 2009; DECC, 2013; Sousa, Rita, and Luís, 2015).

However, the long-term effect of these policies on energy prices is less clear and is influenced by a range of factors. These include specific policy instruments, technology, market context, and policy duration. It is important to note that the relationship between climate policies and energy prices is complex, and the nature of the policies themselves can vary widely. Strategies to mitigate the impact of energy price increases on vulnerable populations, such as low-income households, are deemed necessary.

3. IMPLICATIONS OF ENERGY PRICES ON AFFORDABILITY

A multitude of factors, such as prompt post-pandemic economic rebound, critical mismatch between supply and demand for energy, rising geopolitical conflicts, and poorly designed policies, can drive the surge in energy prices. For example, in Europe, myriad factors are behind the surge in prices, including tensions prevailing in the gas market, the expectation of tighter gas supply, increasing heating energy demand, structural design of the energy market, and weak winds leading to a drop in wind power generation (Belaid, 2022).

High energy prices can significantly impact households with limited financial resources. Rising energy prices can lead to energy poverty, where families cannot afford adequate energy services, resulting in adverse health outcomes and other social issues.

There are two critical ways in which high energy prices place a financial burden on households. First, increases in energy prices lead directly to higher costs of energy services (e.g., cooling, cooking, heating, lighting, and mobility). Second, the cost of energy fuel inputs and raw materials needed to produce goods and services for final consumer use will drive up the prices of household goods and services.

A typical policy response to the disproportionate impacts of energy prices on different income segments is to utilize redistributive policies with an aim to improve energy affordability. For instance, allocations and energy efficiency are the most widely used policy in many countries. Under this policy, governments offer an energy credit for low-income households. However, the question remains whether these policies effectively alleviate this pervasive social issue.

Here, we dive deep into the energy affordability issue and the extent of the phenomenon in Europe. In Table 1, we list the current state of the energy poverty situation in European countries and key existing policies that have been rolled out to tackle the energy poverty issue. We also reflect on the limits of the redistribution and energy poverty mitigation policies, i.e., despite efforts to redistribute carbon taxes revenues and support low-income populations, the extent of energy affordability remains high, as reflected in the current energy poverty shares.

Table 1

Energy poverty extent and policies responses across EU Member States in 2020

Country	Energy poverty share (%)	Existing energy poverty alleviation policies					
		Allocations for energy	Targeted energy payment	Social tariffs	Disconnection safeguards	Consumer engagement	Energy efficiency
Austria	4.2	✔	✔			✔	✔
Belgium	12.6	✔	✔	✔	✔	✔	✔
Bulgaria	49.2	✔	✔				
Cyprus	41.6			✔	✔	✔	✔
Czechia	6.8						
Germany	16.0	✔				✔	✔
Denmark	10.9	✔	✔		✔	✔	✔
Estonia	5.5				✔		
Spain	22.3		✔	✔	✔	✔	✔
Finland	2.6	✔			✔		
France	15.8	✔	✔	✔	✔	✔	✔
Greece	39.2			✔	✔		✔
Croatia	17.5	✔	✔		✔		
Hungary	14.9		✔		✔		
Ireland	6.1	✔	✔		✔	✔	✔
Italy	17.2		✔			✔	✔
Lithuania	33.6	✔	✔		✔		
Luxembourg	5.8	✔	✔				
Latvia	13.2				✔	✔	
Malta	14.9	✔					✔
Netherlands	8.8				✔		✔
Poland	8.9				✔	✔	
Portugal	33.8			✔		✔	
Romania	23.4	✔	✔	✔	✔	✔	
Sweden	6.9				✔	✔	
Slovenia	9.8					✔	
Slovakia	19.2				✔		✔
United Kingdom	13.2%	✔	✔		✔		✔

Source: Belaïd (2022a).

Almost all European countries have implemented specific fiscal and redistribution initiatives to shield households from soaring energy prices (Sgaravatti et al., 2022, Guan et al., 2023). While these redistributive policies partially mitigate the energy poverty issue, a significant proportion of the population in developed countries is still under energy poverty; thus, implying that these interventions might be insufficient to cope with the magnitude of the burden placed on households by energy costs and other goods.

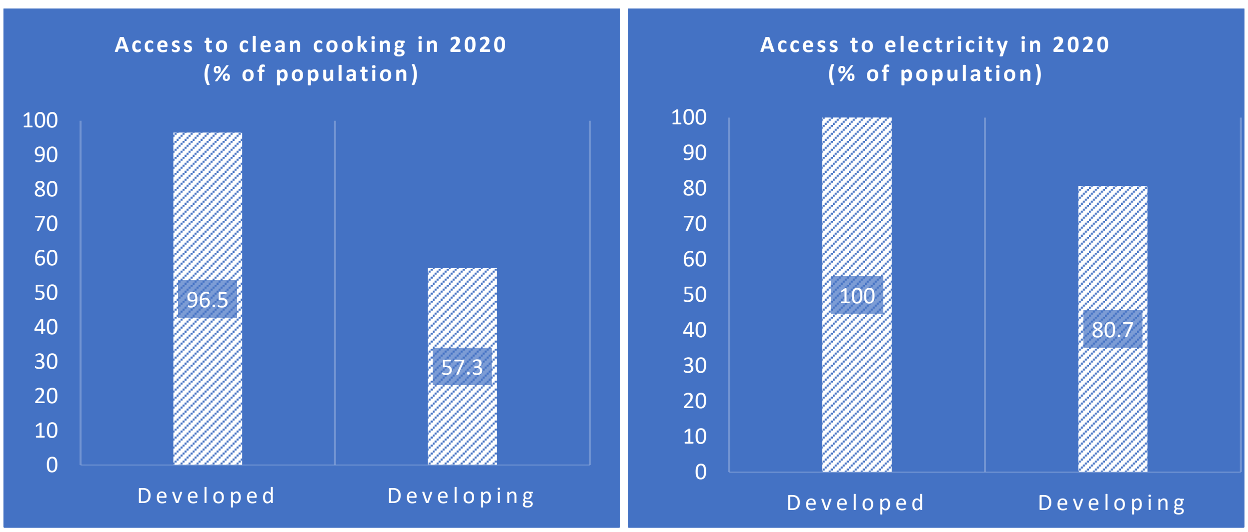
It is important to note that this is happening in the context of developed countries which generally enjoy advanced energy infrastructures and substantial public resources to be able to implement redistributive policies. As these conditions are adversely different in developing countries, the impacts of climate policy on affordability would be substantially more significant, which we explore in the next section.

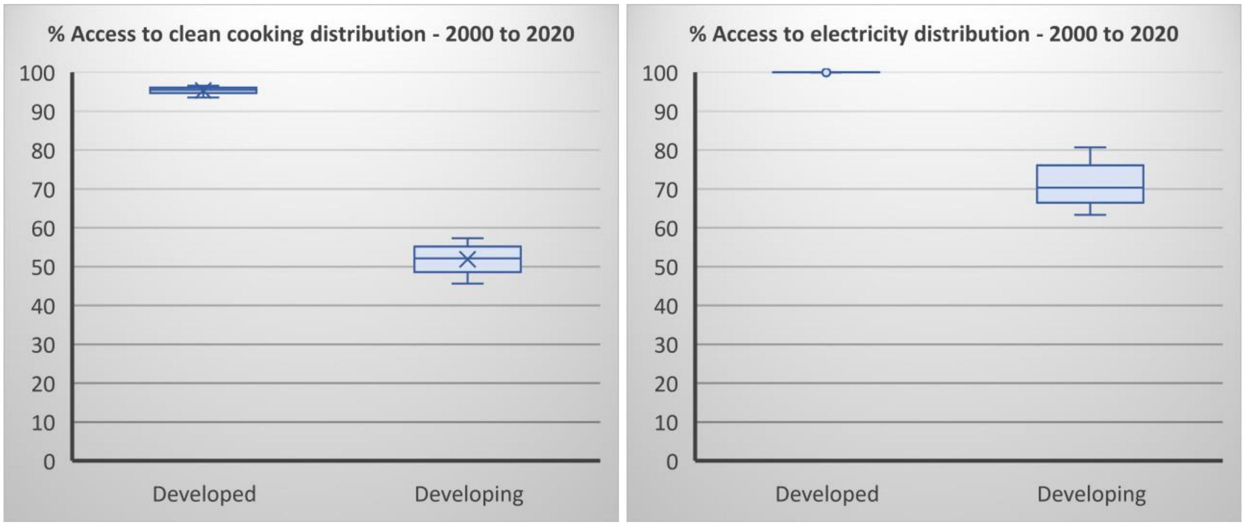
4. ENERGY ACCESS GLOBAL PICTURE: POTENTIAL IMPLICATIONS OF CLIMATE POLICY ON ENERGY POVERTY

Stringent climate policies and the shift to low-emission energy sources will inevitably generate new dimensions of inequality and, in many settings, perpetuate pre-existing sets of winners and losers (Carley and Konisky, 2020). The gainers are the ones who will have access to affordable and cleaner energy options, a more diversified energy mix, and the jobs and innovation opportunities that come with this transition. The losers are the ones who will carry the burdens or lack access to these opportunities.

Moreover, access to reliable and affordable energy is crucial for human development and a fundamental prerequisite for fulfilling basic needs. However, in many developing countries, energy infrastructure remains incomplete, resulting in billions of people without access to energy. As depicted in Figure 3, less than only 57% of the population has access to clean cooking, and about 81% of the population has access to electricity in developing countries. Further, if we look at energy access over time in developing countries, we observe the same pattern: median access to clean cooking is about 52%, and 70% for energy access. These numbers are even lower for least developed countries.

Figure 3: Electricity access and clean cooking access in developed and developing countries

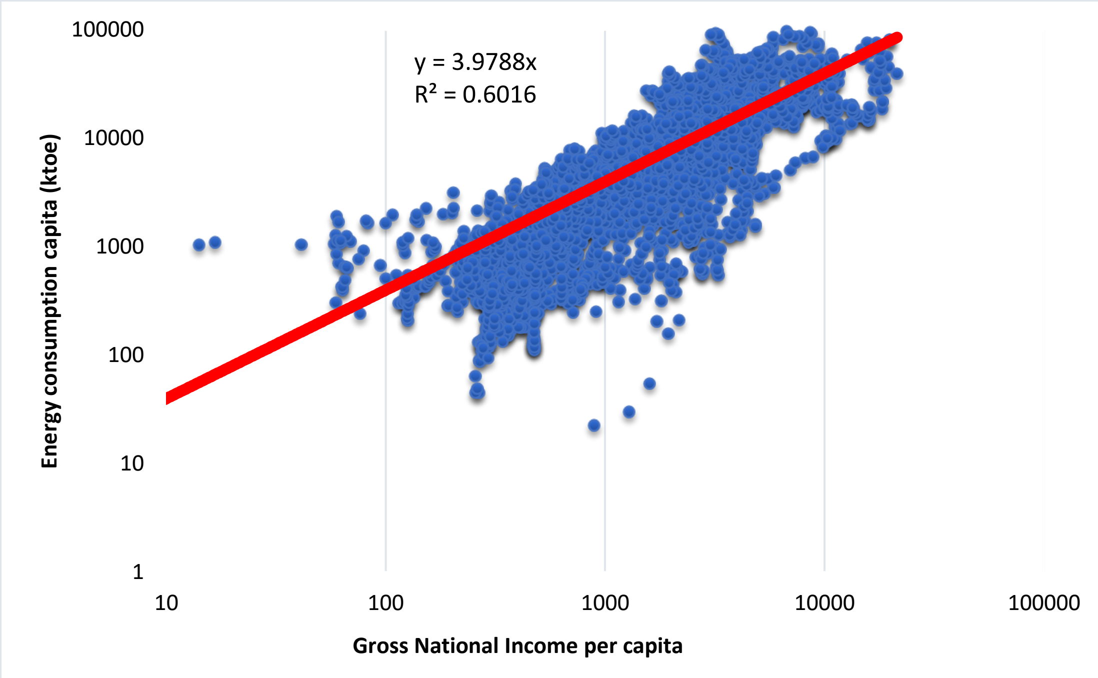




Source: Authors' construction from the World Bank Development Indicators

The limitations to adequate energy services, including intermittent supply and poor quality of energy, are prevalent even among those who have access to energy in many developing countries (Belaïd and Flambard, 2023). The positive correlation between energy consumption and GDP per capita across time and space, as shown in Figure 4, suggests that energy access quality is closely linked to income. An adequate energy supply is essential to economic activity in all countries, and its lack limits revenue and growth. Hence, merely providing access to energy infrastructure does not guarantee high-quality energy services, which is a prevalent issue in most developing countries. This energy poverty has far-reaching consequences, not only affecting individual well-being but also impacting economic growth, social development, and environmental sustainability. In fact, without access to modern energy sources, individuals may have to rely on carbon-intensive sources such as burning wood or charcoal for cooking and heating. Moreover, energy poverty may also lead to deforestation, as individuals may cut down trees at an unsustainable rate to use as fuel. This can have adverse impacts on biodiversity and ecosystem health. Policymakers in developing countries must prioritize improving energy infrastructure and expanding access to energy in a sustainable manner to achieve these essential goals.

Figure 4: Income per capita and energy consumption per capita (strong relationship between energy consumption and income)



Source: Authors' construction from the World Bank Development Indicators. Note : The sample contains 140 countries.

Drawing from the insights related to climate policy and energy affordability in Europe, we discuss the potential implication of stringent climate policies on energy poverty within the developing countries context. Despite the significant poverty alleviation policies, energy poverty rates remain high in EU countries, as indicated in Table 1. Conversely, developing countries face unique challenges such as limited public financial resources, a large number of individuals under poverty with limited access to energy, and more pressing priorities than climate change. These factors make it challenging to achieve sustainable energy access globally.

Another challenge to energy access in developing countries is limiting energy investments to renewables only. There are a range of factors that can make renewable energy systems less affordable in developing countries, even if their production costs are low. One major factor is the upfront cost of building and installing renewable energy systems. While renewable energy generation costs may be low, the initial investment required to build and install the systems can be high. This can make it difficult for some consumers to afford the upfront cost, especially if they have limited access to financing or subsidies. Another factor is intermittency. Unlike traditional fossil fuel-based energy sources, renewables depend on weather conditions, making them less reliable and more expensive to store and transport (Sinsel et al., 2020). This can lead to higher costs for grid operators, who may rely on backup power sources or energy storage systems when renewable energy production is low. These additional costs can be passed on to consumers through higher electricity prices.

Integrating renewable energy sources into existing power grids is also a challenging factor, particularly if the infrastructure is outdated or not designed to handle large-scale renewable energy production (Sinsel et al., 2020). Upgrading the grid may be required, which can add to the overall cost of renewable energy systems. Also, some renewable energy systems, such as wind and solar farms, require large amounts of land to generate significant amounts of electricity. This can lead to conflicts with other land uses, such as agriculture or conservation, and can also increase the cost of the renewable energy system by requiring additional infrastructure and land acquisition. In addition, higher rates of deforestation and biodiversity loss can result from clearing land to accommodate renewable energy facilities, and in some cases, stimulus packages for renewable energy have actually led to increased global emissions due to forest clearing for "renewable" wood-fired generators (Spillias et al., 2020).

Furthermore, critical minerals are vital for the development of many renewable technologies, such as solar panels, wind turbines, and electric vehicles, and they are often found in small quantities and limited regions and are difficult to extract and refine, which involves availability, production, and use challenges. Also, the production and use of critical minerals and rare earth elements can have significant economic and environmental impacts. They can lead to land degradation and fragmentation, threatening biodiversity and ecosystems (WWF, 2021), generate substantial amounts of GHG emissions and other air pollutants, wastewater, and toxic sludge (MIT Climate Portal, 2022; Browning, 2016), and consume significant volumes of water (Vera et al., 2023). Thus, the looming supply gap in critical minerals may short-circuit climate policies focusing predominantly on renewable energy in developing countries.

This highlights the need for the global climate agenda to address the needs of all nations and discourages a one-size-fits-all approach for the global energy transition. Championing technologies individually does not help. For some, for instance, renewables bring their own set of challenges, such as the potential increase in prices of critical minerals required to produce renewable energy technologies, with dependencies and market concentrations similar to fossil fuels, if not higher. It is also important to carefully consider the full life cycle impacts of critical minerals and other elements vital for the development of renewable energy, from a social, economic and environmental perspective to ensure sustainable and inclusive transitions. In the medium-long term, achieving or even approaching climate objectives in an equitable way will necessarily involve new technologies and even new industries. Increasing penetration of renewable energy may also be supported by the rapid use of technologies already at hand, which may be scaled to address some of the above-mentioned lifecycle challenges, including carbon capture and hydrogen. Thus, for some, a more extended transition based on gas may result in sustained emissions reductions in the longer term in a more efficient and politically viable way. Such an approach will also allow a more equitable global burden share in advancing climate solutions.

5. CONCLUSION AND POLICY IMPLICATIONS

Stringent climate policies such as carbon taxes, renewable energy subsidies, and cap-and-trade programs are designed to reduce GHG emissions and combat climate change. However, these policies can potentially result in higher energy costs that may adversely affect energy affordability, mainly for low-income households. This analysis reflects on the inequality risks of decarbonization pathways. Further, it leverages points to achieve the full ambition of sustainable development goal 7 (SDG7), pertaining to securing affordable, modern, reliable, and sustainable access to energy for everyone. The central premise that we investigate in this study is that stringent climate policies may bring new and reassert established dimensions of inequalities by eroding the capabilities of many individuals to meet their energy needs. The findings confirm that climate policies could have a negative impact on vulnerable individuals and must be accompanied by efforts to reduce inequality and energy poverty.

Our analysis indicates a strong association between stringent climate policy and energy poverty. However, the nature of the relationship is complex to capture. It varies on the specific policies and context. On the one hand, policies aimed at reducing greenhouse gas emissions and improving air quality can lead to higher energy costs, which may disproportionately affect low-income households and increase the risk of energy poverty. On the other hand, some policies that promote energy efficiency and renewable energy can also help to alleviate energy poverty and improve access to clean energy for marginalized communities. The impact of climate policies on energy poverty depends on how they are designed, implemented, and enforced, as well as on broader socio-economic factors such as income distribution and access to social welfare programs.

The current energy crisis and skyrocketing energy prices, which were triggered even before the Russian-Ukrainian conflict, are exacerbating the energy poverty situation in developing countries. A recent study estimates that 166-538 million people, or 2.4% to 7.9% of the world's population, are at risk of falling into energy poverty as a result of the crisis (Guan et al., 2023). The study covers 116 countries and predicts that an additional 78 million to 141 million individuals could be pushed into extreme poverty, which represents 1.2% to 2.1% of the world's population. This highlights the urgent need for policymakers to prioritize expanding access to sustainable and affordable energy sources in developing countries to prevent further exacerbating poverty and inequality.

Overall, it is crucial to implement policies that balance the need to lower GHG emissions with the need to protect vulnerable populations and stimulate economic growth. Climate initiatives need the ongoing transition to be both just and inclusive. We identify at least five different types of efforts that would tackle some of the equity dimensions discussed in this contribution: (1) economic and labor force diversification programs, (2) energy assistance and renovation, (3) increasing access to energy technologies, (4) increasing awareness and collaborative actions, and (5) the development of new businesses.

Integrating energy poverty into climate policies is a critical step in addressing the negative impacts of climate policies on low-income households and communities. First, the impact of climate policies on energy poverty should be considered in the policy design process. This can encompass assessing the potential impact on energy prices and developing strategies to mitigate any adverse impacts on low-income households. Second, targeted energy assistance programs are essential to assist low-income households in affording adequate energy needs. This can incorporate initiatives offering rebates or assistance for energy-efficient devices and renovation assistance to lower energy needs. Addressing the root causes of energy poverty is also a powerful action to help alleviate the issue. Policymakers must invest in affordable housing and public transportation infrastructure to lower energy demand and related bills.

Tackling climate change and energy poverty needs to foster international cooperation and solidarity. Developed countries have a responsibility to provide financial support to developing countries to enable them to shift to affordable and cleaner energy systems, while also supporting measures that promote social equity and address the needs of vulnerable and low-income households. Honoring the $100 billion pledge is also crucial for supporting developing countries in their efforts to transition to a low-emissions economy and adapt to climate change impacts. These funds can be used to support a wide range of activities, including energy efficiency and renewable energy projects, clean energy technologies for hydrocarbons and sustainable energy infrastructure, adaptation and resilience measures, and technical assistance and capacity building. To date, progress toward meeting the $100 billion target has been incomplete. While some developed countries have made significant contributions, others have fallen short of their commitments. The lack of transparency and accountability around climate finance has also been a concern, with some developing countries calling for greater clarity and predictability in the funding process.

In addition to the $100 billion pledge, there is an urgent need for innovative financing mechanisms to support climate initiatives. This includes green bonds, climate investment funds, and other forms of public-private partnerships. These mechanisms can help to leverage private sector investment and channel funding toward climate solutions that benefit developing countries. By ensuring predictable and adequate financial resources, developed countries can help to accelerate the transition to a more sustainable and low-emissions future, and ensure that the benefits of climate action are shared equitably across all countries and communities.

A progressive transition to a diversified energy mix is essential to avoid energy systems' disruption, and ensure a smooth and cost-effective transition, while also cutting GHG emissions and tackling energy poverty and climate change. This process may involve various steps, such as setting clear and ambitious objectives for energy poverty and GHG reduction, monitoring progress toward these targets, implementing measures that stimulate a diversified energy mix, e.g., tax credits, investing in research and development in new technologies to reduce the cost, and investing in resilient energy infrastructures, e.g., transmission lines, clean cooking facilities, and storage capacities. In this direction, the circular carbon economy framework has the potential to mitigate both energy poverty and climate change by promoting access to sustainable energy sources, supporting energy efficiency measures, and recycling carbon. More specifically, it calls for managing GHG emissions using all available climate mitigation options rather than advocating for one option. Specifically, CCE promotes the "three Rs" of the circular economy concept: reduce, reuse and recycle (carbon) and adds a novel, fourth R, remove. This results in the 4Rs of CCE: Reduce, Reuse, Recycle, and Remove (KAPSARC, 2020).

There are additional measures that policymakers can leverage to tackle the issue. One of the most important is promoting energy efficiency measures, such as upgrading heating and cooling systems and promoting energy-efficient appliances. Improving energy efficiency will help in reducing energy bills, making energy more affordable for low-income households.

Another important strategy is the increase of investment in energy infrastructures. Governments and international organizations should invest in energy infrastructures to improve access to modern and reliable energy services, such as electricity and clean cooking facilities. This will help increase access to energy in rural and remote areas and reduce conventional solid fuels' health and environmental impacts.

Progressive energy pricing policies are also crucial in addressing energy poverty. Energy pricing policies should be designed to ensure that low-income households have access to affordable energy services. This can be achieved through targeted subsidies, social tariffs, and other forms of financial assistance. In addition, if a carbon pricing scheme is implemented, some of the revenues can be distributed to low-income households to offset the increase in energy costs.

Finally, an entity dedicated to energy poverty with a more inclusive and practical vision that reflects the definition, measures, and responses required to tackle energy poverty can help in enhancing climate and energy poverty policies. Governments should also establish robust research and data collection mechanisms to monitor the state of energy poverty, identify its root causes, and track progress in reducing it. This will help guide policy interventions and ensure that they effectively address the needs of the most vulnerable populations within all societies.

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