

Clean Energy Transitions and Labor Markets*

Go Green Fast: Global Lessons for the Clean Energy Transition

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1 Introduction

Historically, energy transitions have been slow and driven primarily by market mechanisms (Smil, 2018; Fouquet and Pearson, 2012). In contrast, the clean energy transition must be fast if it wants to limit global warming and it must be – to some extent at least – policy-driven to overcome the many market failures that plagues it (Unruh, 2002; Breetz, Mildenerger, and Stokes, 2018; Aklin and Urpelainen, 2018; Nahm, 2021).

The need for speed coupled with heavy government involvement create several challenges for labor markets that may have been underappreciated. Decarbonizing an economy is a problem of unprecedented scale. From coal miners to gas station clerks, millions of workers are vulnerable – directly or indirectly – to decarbonization. Some might find refuge in new jobs created under the premise of a ‘green’ economy (Pai et al., 2020; Lim, Aklin, and Frank, 2023). While these jobs are welcome, it is unlikely that they will suffice. For reasons discussed below, fossil fuel workers cannot be expected to exit their current jobs seamlessly and quickly (Lim, Aklin, and Frank, 2023). This, in turn, creates political frictions that undermine public support and jeopardize the pace at which new clean energy policies can be deployed (Stokes, 2015; Egli, Schmid, and Schmidt, 2022).

In this paper, I examine the problem of the reallocation of fossil fuel workers in general and how policies could and have been designed to address it. Throughout, I try to flag how the problem may change across jurisdictions and across segments of the carbon economy. I try to make three contributions. *First*, I spell out what sets labor markets dominated by fossil fuel employment apart from conventional ones. Geographic concentration, high levels

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of dependence on a single employer, and an inability of fossil fuel companies to adapt jointly create unique challenges for the reallocation of workers away from the carbon sector. *Second*, I discuss the practical implications of these three features for energy transition policy. I focus in particular on problems caused by geographic immobility and skill gaps between current and new potential jobs, how it affects policy options, and whether existing policies address these problems. In particular, the features of the problem suggest a need for place-based (over people-based) policies, but these in turn are vulnerable to political failures. *Third*, I conclude with several open questions that need good answers.

2 The problem

Key features

The type of problem that we are dealing with – the reallocation of possibly millions of workers to new jobs – departs from typical policy problems in significant ways. It is not just a public bad problem that can be addressed by, say, Pigouvian taxes. Instead, the type of problem that this paper deals with combines three features that make it different from other collective action issues. They also make it relatively rare, though not unprecedented.

First, the clean energy transition is a problem of *geography*. Industries vary in the degree to which they are geographically concentrated (Glaeser, 2000; Baldwin et al., 2011). Some sectors can be found anywhere. Others cluster in space, which happens when there exit considerable agglomeration effects (Rosenthal and Strange, 2004). Clusters emerge because of proximity to consumers (e.g., early mechanized textile factories were often located near London) or because of geological factors. The latter, of course, is relevant to the problem of the clean energy transition, given that fossil fuel firms (and their employees) tend to be concentrated near fossil reserves (While and Eadson, 2022; Gaikwad, Genovese, and Tingley, 2022). Geography, in turn, creates two challenges when an industry declines: there are many workers who will be simultaneously looking for work, and they will not necessarily be able to move to capitalize on new job opportunities elsewhere (Lim, Aklin, and Frank, 2023).

Second, the problem at stake is one of *localized dependence*. Some industries dominate local labor markets (Moretti, 2010). Historically, examples of dominant firms include so-called ‘company towns’ where most jobs were directly provided by one employer or by its subsidiaries. This was the case for several coal companies in West Virginia, for instance (Green, 2015). The modern example of this story includes Microsoft, which represent a sizeable employer as well as generator of indirect and induced jobs in and around Seattle (Moretti, 2012). In our case, the problem is not just that the fossil fuel sector is geographically concentrated,

but that it is often also dominant within a labor market. Such labor markets are ‘thin’: when someone loses their job, it is hard for them to match to a new one (Di Addario, 2011; Frank et al., 2018).

Third, the clean energy transition requires *disruptive innovations* to be successful. Firms are typically good at dealing with ‘sustaining’ innovations, that is, marginal changes in the way they produce stuff. They often struggle with ‘disruptive’ innovations that require a change in their expertise and customer basis (Foster, 1986; Christensen, 2013). In a very different market, Kodak’s inability to cope with digital photography illustrates this point.¹ Most incumbents in the fossil economy – extraction companies, utilities, etc. – proved unable or unwilling to deal with the revolution caused by renewable energy. There are many reasons for this, including a reliance on old customers to learn about the market, conservatism among employees, and a mismatch in skills needed to capitalize on new technologies.

The labor market challenge of the clean energy transition occurs when these three conditions are met: it is the problem of a geographically concentrated industry that is dominant in its local markets, when it faces an unexpected decline that it cannot overcome on its own. This definition of the problem sheds light on why the problem of, say, the decline of coal differs from the problem of cab drivers threatened by Uber. While both are exposed to new technologies, only one is geographically concentrated and dominant in some markets.

Note that there will be considerable variation across countries and across sectors. Countries vary in the way they design and support labor markets (Betcherman, 2012). Furthermore, the above matches reasonably well the case of the fossil fuel sector. Other industries that are carbon-dependent will face different configurations of geography, dependence, and disruptions. We must therefore be cautious regarding how much one can learn from cross-sectional evidence.

The speed at which decarbonization must happen aggravates these problems. In the long term, disruptive innovations and new clusters become the schumpeterian forces through which higher levels of welfare are achieved at the macro level (Schumpeter, 1934; Aghion and Howitt, 2008). The problems appear when this has to happen fast. The market that we are looking at here is typically thin. It is doubtful that markets dependent on fossil fuel employment can rapidly reallocate workers to new and equally appealing jobs. As a result, at-risk citizens often become hostile to climate policy (Stokes, 2015; Egli, Schmid, and Schmidt, 2022). Thus, there exists a plausible need for policy interventions that differ from the usual tools used to deal with public bads and other collective action issues.

¹“How Kodak Failed,” *Forbes*, January 18, 2012, [\[link\]](#).

3 Practical implications

Implications

The problem, as stated, generates several key practical implications for politics and policies.

First implication. Because of its geographic concentration and regional importance, any fossil fuel phase out will impose deep but localized costs. These costs go beyond those directly employed in the fossil fuel sector. Indirect jobs (along the supply chain) and induced jobs (e.g., local service sector) are also affected. This increases the risk of pushing these regions into poverty traps, akin to what happened to many de-industrializing regions in France, Belgium, and the Rest Belt (Franck and Galor, 2021).

Second implication. The core of the policy problem is to facilitate the reallocation of large number of workers located in thin markets. The sheer (relative) volume of workers means that public interventions might be needed to solve the coordination problem of job matching. These interventions must be scalable beyond those immediately employed by the fossil fuel sector.

Third implication. Fossil fuel firms are unlikely to evolve and adapt. Instead, it seems likely that they will continue to rely on non-market strategies to maintain themselves. In the absence of good exit options, we may expect attempts to build up local support for their cause. In any case, they are unlikely to be generating new jobs in at-risk regions. (The same might not be true for firms that are less directly dependent on fossil fuels, such as the car industry.)

Corollary to the third implication. Since fossil fuel firms cannot be expected to adapt, the policy problem becomes a choice between (a) facilitating the (spatial) exit of workers to other labor markets and (b) attract new drivers of growth to their current location. This is a difficult ethical and political problem.

4 Politics of policy design and implementation

The nature of the problem at stake makes public policy intervention both politically necessary and ethically justifiable. But how should policy be designed? And what pitfalls ought be avoided? Whenever possible, I draw on examples from relevant policies implemented in recent history.

Comment on the *First and Second implication*

Finding new jobs for (1) a (relatively) large number of people (2) in small geographic areas (3) in a short amount of time is a daunting task. This differs from the problem of dealing with

regular business cycle fluctuations and recessions. The latter can be addressed with vigorous fiscal and monetary policy. Here, a fossil fuel phaseout can happen even though the rest of the economy is doing well. Thus, policies that address the problem of labor reallocation need to acknowledge its geographic dimension (Kline and Moretti, 2014).

Policies must also find ways to facilitate job transitions to workers *as they are*. It is not just about generating a large number of jobs; a share of these jobs must be filled by those who lost or will lose their position. To do so, two labor market constraints must be taken into account: spatial and skill frictions. First, workers may be tied geographically to their old workplace. Studies show that home-ownership, for instance, reduces mobility (Dohmen, 2005). Workers may also depend on their social networks for services such as childcare. It is hard to move to, say, Austin TX with three kids if you cannot afford daycare. Lastly, blue collar workers are generally much more dependent on their social network to find new jobs. Unlike the white collar professional market, where an candidate in New York can be matched with an employer in Los Angeles, blue collar positions are often filled via word-to-mouth searches (Carnevale, Jayasundera, and Repnikov, 2014).

Second, fossil fuel workers may or may not find it easy to switch industries. Over the course of their careers, workers develop sector-specific skills (Arrow, 1971). These skills increase their returns (fossil fuel workers are often well paid) but limit their outside options. Workers pushed out of their industry often experience large pay cuts (Braxton and Taska, 2023). Regulatory barriers, such as licensing laws, sometimes compound this problem (Kleiner, 2000). For instance, a coal mine electrician in West Virginia is not automatically allowed to operate as a regular electrician. Instead, despite their on-the-job experience, they must retrain for several years before receiving their license.²

The need for re-skilling is often recognized in public programs established in recent years. In Illinois, the Climate and Equitable Jobs Act (2021) includes provisions for re-training the fossil fuel-dependent workforce.³ In Colorado, the Office of Just Transition provides resources to fossil fuel communities but also tries to reduce frictions of the labor market in these areas by identifying employers and job opportunities. The state is not the only actor in this area. In South Africa for instance, Exxaro and Seriti (two coal mining firms) signed an agreement in 2021 with Eskom (the main public utility) to provide re-skilling opportunities to people living in coal-producing regions.⁴ Re-skilling demands are often formulated by unions. In Australia,

²“Enable a just transition for American fossil fuel workers through federal action,” Michaël Aklin and Johannes Urpelainen, *Brookings*, August 2, 2022 [link].

³“Gov. Pritzker Signs Transformative Legislation Establishing Illinois as a National Leader on Climate Action” [link]

⁴“Eskom, Exxaro and Seriti sign MOU towards low carbon future” *Political Analysis South Africa*, October 25, 2021.

local unions called for the government to ensure a smooth transition across sectors for fossil fuel workers affected by its Offshore Electricity Infrastructure bill of 2021. During these debates, a representative of the Electrical Trades Union of Australia said “An offshore wind research and development programme is needed, alongside measures for a just transition to support skilled workers in getting the additional qualifications they may need to transition to this new [renewable energy] industry.”⁵

Lim, Aklin, and Frank (2023) provide evidence regarding the relative importance of skills mismatch and geographic mobility for US fossil fuel workers. They show that these workers are extremely immobile. When switching jobs, the vast majority finds a new position within 20 miles of their old workplace. Skill-wise, these workers are somewhat more flexible and are reasonably well prepared to capitalize on new green jobs. Thus, the amount of re-skilling necessary to switch industries could well be manageable. Unfortunately, these new jobs are unlikely to be located near fossil fuel-producing regions based on reasonable projections (Pai et al., 2020; Lim, Aklin, and Frank, 2023).

From a policy standpoint, then, a key result is that public programs must assess the barriers to geographic and sectoral mobility. If authorities wish to attract new firms (more on this below), they must consider focusing on new sectors that are close (geographically and/or skill-wise) to current fossil fuel workers. This stands in contrast to calls for unconditional diversification of local economies, which are unlikely to succeed (Alshamsi, Pinheiro, and Hidalgo, 2018).

Comment on the *Third implication* and its *Corollary*

The decision to (try to) rejuvenate a region or help workers move is morally thorny. Setting aside notions of economic efficiency, telling people that there is no future to be expected in the place they live and grew up in is not something that can be done lightly – if at all. This being said, I want to make two observations here.

The first observation is that this question connects to debates between people- and place-based interventions. Place-based policies recognize that geography is sticky and thus help is sometimes best targeted toward specific areas. In the United States, for instance, the Empowerment Zone program launched in 1992 provided small regions with employment tax credits and grants to help support businesses (Busso, Gregory, and Kline, 2013). The ambition of place-based policies is to taking a holistic approach that preserves communities (Neumark and Simpson, 2015).

⁵“Calls for local content mandate for Australia’s burgeoning offshore wind industry,” *Upstream*, September 6, 2021, [link].

People-based policies, by contrast, target specific groups (Ladd, 1994). These avoid dead-weight losses caused by subsidizing firms that do not need it. However, there is no guarantee that, after receiving help, people will stay where they are. In fact, it may be an objective of people-based policies to encourage movement within a jurisdiction. This was the case for the *Moving to Opportunity* program, for instance, which encouraged residents from poor neighborhoods to move to wealthier areas.

Based on the problem as stated here, there are reasons to think that place-based approaches might be more effective. Some of these derive from what was said above: it is a geographically concentrated problem. Furthermore, it is a problem that is likely to go beyond workers immediately employed by the fossil fuel sector. Given its localized dominance, there could be a multiplier effect that causes job losses well beyond what direct employment would lead us to expect. In fact, some of the most successful transitions from a labor market perspective, such as the Ruhr in Germany, happened via holistic, regional approaches (Oei, Brauers, and Herpich, 2020). Recently, just transition policies in Spain appeared to have been electorally popular (Bolet, Green, and González-Eguino, 2023).

The second observation is that this question is not only moral, but also political in nature. one might speculate that the relative appeal of place- versus people-based policies depends on electoral institutions (Rickard, 2018). Single-member districts might incentivize politicians to support place-based strategies, whereas people-based approaches might appeal to multi-member district systems. And in fact, I was not able to locate many examples of pro-relocation policies. There are fewer examples of explicit encouragements to move workers out of fossil fuel regions. One (rare) example comes from Poland. Under a phaseout deal between the government and coal stakeholders, the former agreed to offer miners “the right to relocate from closed mines to ones still operating, or get early retirements at 80% of their salaries.”⁶

Yet there are considerable reasons to be wary about place-based interventions on political economic grounds. Business incentives are often socially costly, ineffective, and ultimately used to extract rents rather than to build up economic growth (Krueger, 1974; Jensen, Findley, and Nielson, 2020; Jensen and Thrall, 2021), though this is not universally the case (Rodrik, Grossman, and Norman, 1995). And even if policies are designed to avoid rent seeking, the transfers involved could still create considerable deadweight losses and a subsidy of (relatively rich) landowners (Kline and Moretti, 2014).

The politics of policy implementation are thus critical and far from an easy problem to solve. Aside from rent-seeking, stakeholders may worry about the credibility of long-term policies (Gazmararian and Tingley, 2023; Aklin, 2023). The implicit deal is the following: governments provide resources to workers and their communities in exchange for the phase-

⁶“Polish govt, unions initial plan to phase out coal by 2049,” *Reuters*, April 28, 2021, [link].

out. Yet this happens at best over several years (Oei, Brauers, and Herpich, 2020). To be credible, such a policy must be credible over potentially several electoral cycles. Thus, how to lock-in such commitments is critical. In Germany, for instance, this problem was overcome by delegating resources and oversight to a semi-public organization (the so-called “Coal Commission”).

In sum: there are good reasons to support place-based solutions to labor market challenges. However, these raise questions regarding the implementation of policies and their long-term credibility. Poor implementation could lead to public hostility and wasted resources. Long-term credibility problems could undermine the very ambition of these projects.

5 Next steps

In lieu of a conclusion, I will highlight several problems that deserve further scrutiny.

First, our measurements of workers’ vulnerability are coarse. We can make reasonable guesses in the United States and Europe thanks to data on occupation-level skills and local labor market conditions. However, such data are generally unavailable in other countries. Notably, there is no commonly accepted way to measure skills and expertise in informal markets.

Second, we know little regarding the aspirations and policy preferences of at-risk communities, with some exceptions (Gaikwad, Genovese, and Tingley, 2022; Blankenship et al., 2022). It is one thing to list policy options such as re-skilling or relocation; but what do people actually want? By extension, we also have only partial knowledge regarding the effectiveness of various policy options. Several studies and policy white papers have been produced in the last fifteen years to discuss regional economic turnaround (e.g., Vey, 2007; McGahey and Vey, 2008; Safford, 2009; Hobor, 2013; Kim and Pelc, 2020), but few conduct systematic impact assessments outside the United States – not just of economic but also of political outcomes (for a review, see Kline and Moretti, 2014).

Third, labor market frictions are often political in nature. Occupational licensing, for instance, is a topic that received a lot of attention in labor economics (Kleiner, 2000). Yet licensing often has political sources such as union activism and corporatism. Likewise, political factors could explain considerable cross-national variation in mobility, including education and education policy, the existence of social safety nets, and so forth.

Lastly, what kind of resources are needed to respond effectively to these challenges? Putting a price on these initiatives is tricky (Pollin and Callaci, 2019). While some, like the EU, are now devoting considerable amounts, whether this money will be effectively used remains an open question. Furthermore, it is also not clear what kind of capacity is needed to

make good use of these resources. Initiatives such as the Just Energy Transition Partnership between South Africa and several European countries suggests that the need for capacity-building is recognized, but how can we make it effective?⁷

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⁷“Just Energy Transition Partnerships: An opportunity to leapfrog from coal to clean energy” [\[link\]](#)

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