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Introduction

Carbon County in Wyoming has seen better days. Coal mines that provided for generations of local jobs have shuttered. The reasons for the industry's decline are myriad; cheap natural gas prices and the growth of renewable electricity certainly contributed. But this is no consolation for residents who feel that their community's identity and economy are under siege.

Terry Weickum, the county commissioner, had a hard decision to make. Should he allow new wind farms to be built in the heart of coal country? Wyoming, endowed with sweeping vistas and constant gusts of wind, is one of the best places in the nation for wind energy. Wind turbine construction could offer a path to diversify the stagnant local economy with new jobs and tax revenue.

However, the benefits from wind were not self-evident. Outside Carbon County, concern about climate change drives the deployment of renewable energy. Inside Carbon County, Terry warns that people only mention global warming "if they want to be punched in the face."[1] This is coal country, after all. Locals were "horrified that wind would change our way of life." It would take up land for hunting and camping, threaten tourism, and, worst of all, it would compete with coal. Change is hard, Terry declared, and "the fear of the unknown is the scariest thing in the world."

Terry leapt into this uncertain future. He welcomed wind but is clear that "I didn't do it for idealistic reasons." Carbon County needed the jobs and tax revenue. Wind did make a difference. However, Terry is

[1] Interview, November 3, 2022. Also see Hu (2021) and Searcey (2021).

clear-eyed about the scale of the benefits. For one, the jobs largely went to outside teams and have proven temporary. "There would be 300–400 people who would come in and do work, and then they are gone," recalled Terry, now the mayor of Rawlins, Wyoming. And while the tax revenue brought in by wind projects "helped our community immensely," it by no means has offset the economic decline in the area. "The last year I was a county commissioner, we collected about $30,000 worth of taxes, and that will fix about 30 feet of road, so grandma at the end of the block on a fixed income would have to pick up a tab." In the same year, Terry lost his re-election to the commissioner's office by 24 votes, a loss he attributes to his support for wind.

Would other communities make this leap into the clean energy future? In Carbon County, "coal is not coming back," according to Terry, so the decision was easier. But in neighboring Campbell County, where coal remains king, as well as oil, there is no question about what industry the community wants to bet on. As Terry puts it, "I'm not going to shoot the horse I'm riding until I have another horse."

Carbon County is not alone in the challenges that it faces. Across the country and around the world, a massive transformation in energy and industrial systems is already underway. New legislation hopes to accelerate that process, and still, more is in store. Communities that rely on fossil fuels and those where clean energy must be built have hard choices to make about their futures.

THE CLIMATE IMPASSE

These transitions will be necessary to tackle the climate crisis. And we cannot afford to wait. Each day we burn fossil fuels adds more greenhouse gases (GHG) to the atmosphere, which further bakes the planet. The consequences of elevated temperatures are dire. The United Nations body that brings together scientists from around the world to assess knowledge about climate change concluded that global warming has already worsened fires that burn through homes, hurricanes that flatten communities, and sea level rise that floods cities (IPCC, 2022). These impacts will only intensify if temperatures climb unchecked.

Contrary to what some might say, the clean energy transition is not just an engineering challenge. It's a political problem. We know what needs to be done to solve the climate crisis. The world must move away from coal, oil, and gas, the primary sources of harmful carbon dioxide emissions and other planet-warming gases, and toward cleaner

energy sources. While innovation will be crucial, humanity already possesses the technologies needed to start this transition. As early as 2004, studies showed how current technologies could be scaled up to decarbonize the economy (Pacala and Socolow, 2004). More recently, a team of researchers as part of the *Net-Zero America Project* found that the United States could use already existing technologies to reach net-zero emissions, the condition where global emissions plateau because the amount of GHGs that enter the atmosphere is balanced by removal from the atmosphere (Larson et al., 2021). The relevant question is not if it is feasible to start the transition but how governments and stakeholders should proceed.

But governments are not moving fast enough to solve the climate crisis. The world came together in 2015 to ratify the Paris Agreement, which sought to limit global warming to well below 2°C, or better yet, 1.5°C. However, there is no magic threshold at which the planet is safe; every degree matters. Nonetheless, it is worrisome that the latest assessments show that even if all countries kept their pledges, the world would still fall short of that 1.5°C target (Meinshausen et al., 2022).

Some had hoped that as clean energy became cheaper, the problem would resolve itself through market forces. Experts thought that coal use had plateaued in 2021, with renewable energy sources at their lowest prices ever. However, the next year, global demand for coal soared to record highs.[2] Even if coal use flattens out or starts to decline, this still represents substantial emissions that we cannot afford. And outside of coal, so-called natural gas and oil remain ubiquitous sources of emissions. How can we break this climate impasse?

BREAKING THE IMPASSE?

There are two strategies for political reform that could break the climate deadlock: reduce opposition and create allies. Governments could help the people, communities, and companies harmed by the energy transition with compensation for lost jobs, tax revenue, and health impacts. Households will lose income, and workers must retrain. Localities will lose funds to provide public goods like schools. Workers and their families may lose health benefits, even as they carry the health burden from hazards at their old jobs and proximity to pollution. The anticipation of these costs creates opposition, but the government could reduce

[2] For energy projections, see International Energy Agency (2022b).

this resistance with transitional support for workers, their families, communities, and maybe even companies.

Reformers could also use the benefits from the new green economy to create allies. They could attempt to reframe the climate issue in a way that makes political action feasible, which political scientist Robert Keohane (2015) argues is a potential strategy to break the impasse. Rather than focus on costs, advocates should emphasize the short-term benefits of the energy transition, such as jobs and tax revenue generated from the construction of solar farms, the assembly of batteries, and the installation of energy-efficient products. It is these benefits that convinced Terry in Carbon County to welcome wind. This is also the logic behind "green industrial" policies that hope to encourage the growth of new industries that create or strengthen constituencies that defend climate policy (e.g., Rodrik, 2014). Look no farther than the 2022 Inflation Reduction Act (IRA) in the United States, which ushered in billions of dollars of green incentives, as well as funds for fenceline communities that have suffered from industrial pollution. Experts are also optimistic that new green industries will be a tremendous source of jobs that could even offset employment losses in carbon-intensive industries.[3] If new allies can be created, then the opponents of the energy transition, such as fossil fuel companies, could be outflanked or even converted into supporters.

Despite the promise of these strategies, attempts to break the climate impasse have struggled. This book diagnoses why and what can be done. Credibility and economic opportunity are the watchwords in our analysis. We have spent time on the front lines of the energy transition, listening and learning. What we hear from workers, communities, and companies are concerns about whether the government will follow through on its promises to provide compensation and make investments. Worse, they've seen these promises made before and broken. And doubts abound about whether clean energy will support livelihoods and uplift communities. This is a book about uncertain futures, but it is also about how these promises could be more credible.

VIEW FROM ON HIGH

Experts typically view strategies to break the climate impasse from the *top down*. From this 30,000-foot perspective, it would be a simple task for the government to reduce costs, create allies, and then break the

[3] For example, Sustainable Development Solutions Network (2020).

climate impasse. All the government would have to do is identify the correct level and target of support for dislocated workers and new industries. To this end, political scientists have amassed reams of studies that explore how social programs like unemployment insurance can buffer the public from economic disruption (e.g., Iversen and Soskice, 2006; Ruggie, 1982). Likewise, economists propose – and debate – place-based development programs that aim to promote growth in stagnant regions "left behind" (e.g., Austin, Glaeser, and Summers, 2018). These challenges with economic transitions are familiar. Since the advent of markets, industries and occupations have emerged and disappeared at the hands of policymakers and technological change – carriage-makers obsolesced by the automobile, assembly line workers replaced by robots, and coal miners displaced by new energy sources.

But what stands in the way if we have been here before and have the tools for political reform?

Three Challenges Remain

Why Do Fossil Fuel Communities Resist Compensation?

First, why are the people whom compensation and investments hope to help skeptical of these promises? From the top-down perspective, the inability to reach a compensatory bargain with those who would lose from climate policy is puzzling. Some even set aside oil and gas and ask, shouldn't it be a simple task to "buy out" coal miners who are small in number? Given the political will, a country like the United States could easily provide abundant aid to places impacted by the energy transition. Such a bargain would appear politically shrewd since public opinion polls show how compensation for fossil fuel workers garners support from the national public and residents of coal, oil, and gas communities.[4] Yet, voters in fossil fuel regions overwhelmingly support politicians who block compromise on climate policy. Why have fossil fuel communities resisted the clean energy transition despite the availability of popular compensation and investments?

[4] See Bergquist, Mildenberger, and Stokes (2020), Gaikwad, Genovese, and Tingley (2022b), and Gazmararian (2022c). Studies on responses to economic or policy risks find that individuals become more supportive of compensation (e.g., Iversen and Soskice, 2001; Scheve and Serlin, 2023; Walter, 2010). Lawmakers also support costly reforms when there are more generous social welfare policies (e.g., Kono, 2020).

Why Do Reformers Struggle to Find Allies?

Second, why do advocates struggle to find allies despite the prospect of benefits from the clean energy transition? Major renewable energy projects have been canceled due to local opposition.[5] Despite there being solutions to share resources with traditional opponents of solar and offshore wind like farmers and fishers, groups struggle to find these pathways to cooperation. One county official we surveyed in Louisiana said, "[I] don't think renewable energy is a good sector for investment." A politician from a municipality in Kansas implored, "please don't invest my money into the renewable energy currently being offered." Even outside of political officials whose views might be clouded by partisanship, in our interviews, unions engaged in renewable energy projects also raised concerns about local benefits.[6] A report from a network of global investors concluded that the "[l]ack of community support could undermine the rapid deployment of clean energy at precisely the time we need it most" (Ceres, 2020, p. 5). Why do communities not always see the benefits from the clean energy transition?

Why Do Green Workforce Shortages Persist?

Third, why do governments and the private sector struggle to build a green labor force despite the societal demand for clean energy? The *Net-Zero America* team estimates that the energy transition would create 300,000 to 600,000 green jobs by mid-century. A similar expansion around the globe will be needed, which could create up to 11.6 million direct and indirect energy sector jobs (Gielen et al., 2019). Yet, there are already hiring difficulties and warning signs that the clean energy transition will run up against "employment bottlenecks" (Larson et al., 2021, p. 306). Why do workforce issues persist despite the growing demand for green jobs?

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These questions are puzzling from the top-down perspective. People fall back on simple answers. One view is that fossil fuel lobbyists have bought off politicians and misinformed the public's beliefs about climate science. Another explanation is that partisan polarization is so great that meaningful political reforms cannot pass. Money in politics and polarization are undeniable features of the American political landscape. Yet

[5] See the abandoned plans for a 400-megawatt solar farm in Williamsport, Ohio (Gearino, 2022).

[6] For a review of the literature on opposition to energy projects, see Carley et al. (2020).

these challenges with the energy transition exist throughout the world, even in countries with less business influence and with low polarization. And from the perspective of what is to be done, the answers these diagnoses afford are unsatisfying. Remove money from politics? Good luck. Change the minds of a climate skeptic with scientific facts? Not in this lifetime. New ideas and solutions are needed.

But what is especially puzzling about these explanations for the climate impasse is that they ignore the complex and sometimes contradictory beliefs that people have about the energy transition. When we listen to residents of Southwest Pennsylvania, local officials in Carbon County, and the leadership at electric power companies, a different picture emerges. In their unique ways, they raise a common concern: credibility. How can one be confident that the government will deliver on promises to support workers, their families, and communities in the transition? How can one be sure that promises of new jobs and tax revenue from green industries will materialize, endure, and provide local benefits? What looks certain from the top down is fraught with ambiguity from the ground up – that is, from the standpoint of workers, communities, and companies.

Many communities already know what's coming because they, like Carbon County, have been living the energy transition. They have been crushed as the nation has begun to move to gas and other rivals for coal. Worse, the policies experts say can help provide a safety net to communities harmed along the way, such as job retraining, have been promised before, and these workers, their families, and communities have seen those promises evaporate.

In places that might benefit from the clean energy transition, including communities that have borne the cost and received none of the gains, there is also an uncertain future. They, too, have seen the pendulum swing of political control and, with it, support for new investments. Local leaders, business people, and workers wonder whether their community would be better off by embracing the green transition.

OUR ARGUMENT

The main argument of this book is that the credibility of the government's promises and the availability of local economic opportunities shape individuals' attitudes, beliefs, and preferences regarding the clean energy transition. Credibility refers to the concern that the government may not deliver on its promises, and local economic opportunity captures

the idea that people worry about whether investments will make communities and workers better off than before. Credibility and economic opportunity are essential. The energy transition will require people, communities, and companies to leap into an *uncertain future*. People would be more likely to jump into this green future if they believed in the government's promises of compensation and investments, as well as the economic opportunities provided by new industries and occupations.

Why do these credibility challenges exist? We identify at least three reasons. People worry that economic and political conditions will change and unwind political reforms, that voters are unwilling to pay for the cost of the transition, and that the government cannot be trusted to keep its word.

The origin of this uncertainty becomes apparent when one considers the energy transition from the ground up. Throughout the book, we spotlight stories from people in communities on the front lines of the energy transition to show how these concerns manifest. At a time when social, economic, and political divisions can make us feel so far apart, we often fail to stop, listen, and learn. Our ground-up perspective provides a voice to people often left out of the national dialogue. Their experiences must inform the discussion around decarbonization, associated policy changes, and institutional developments if we are to understand the problem and find lasting solutions.[7]

While we primarily focus on the United States, a major producer and consumer of fossil fuels, credibility challenges confront all countries, levels of government, and even companies. In developing nations like China, India, Indonesia, and South Africa, these challenges might be even greater. In places with established social safety nets and greater trust in government, like some European countries, these issues might be less intense. Despite these differences, credibility remains a fundamental constraint on any long-term political reform.

Problems need solutions. What can make government promises more credible? How can investments deliver local benefits so people think they would be as well or better off by embracing the energy transition? One strategy to create credibility is to delegate to communities to make their voices feel heard. Another solution is to implement reforms with laws that are harder to overturn rather than unilateral actions by presidents that future leaders can reverse. Policies to create transparency around

[7] For other efforts to listen, see Ansolabehere et al. (2022), Beckfield et al. (2022), Cha et al. (2021), Cramer (2016), Curtis et al. (2022), Foster et al. (2022), Maxmin and Woodward (2022), Moniz and Kearney (2022), and Wuthnow (2018).

the local benefits of green investments can also ensure that companies do not over-promise and are held accountable if they fail to deliver. These are just some of the tools we develop – grounded in decades of social science scholarship – and examine with evidence. The most important finding is that efforts to make policy credible and deliver local benefits can build support for the clean energy transition, even when these reforms are costly.

CLIMATE TRANSITIONS FROM THE GROUND UP

What do climate transitions look like from the ground up? The rapid rise in GHG emissions affects not only the climate but also communities as they try to adapt to impacts like rising seas, wildfires, and floods. This adaptation represents the first facet of climate transitions. The second facet of climate transitions is the transformation of the basic structure of the economy, which relies on fossil fuels. Our book focuses on this second aspect of climate transitions, the clean energy transition.

This transition will be challenging because carbon-intensive energy permeates all economic activities: fossil fuels power our homes, factories, and cars (Unruh, 2000). As the energy transition unfolds, the impacts will ripple from coal, oil, and gas to broader swaths of the economy. The geographic scope of this transition in the United States is vast. Figure 1.1 shows how much fossil-fuel intensive industries contribute to

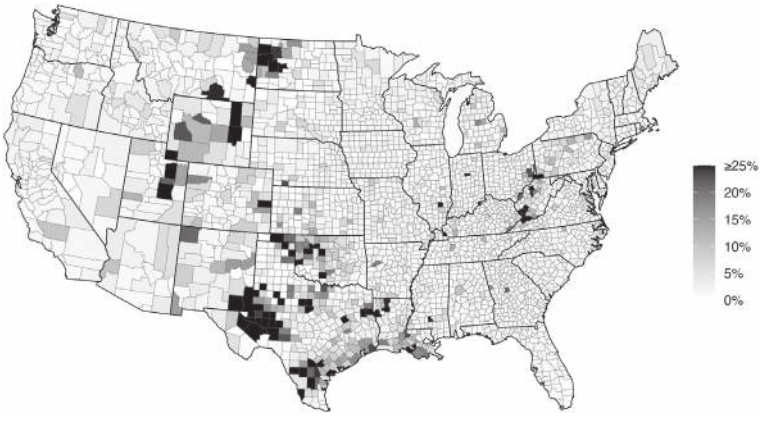

FIGURE 1.1 Percent of county wages in 2020 from fossil fuel-intensive industries, including oil and gas extraction, coal mining, petrochemical manufacturing, electric power generation, internal combustion engine manufacturing, and gasoline stations.

local wages.[8] The map focuses on pay because it represents the extent to which an industry supports livelihoods. We try to capture the vast array of industries and occupations tied to coal, oil, and gas. This includes jobs in oil and gas to drill wells, build pipelines, and manufacture petrochemicals; careers in coal to mine under and above the surface; and people who work to generate electric power from fossil fuels.

The energy transition's effects will be felt in unexpected ways beyond these traditional industries. For example, as consumers shift to electric vehicles (EVs), there will be less demand for internal combustion engines, which impacts automotive workers who assemble these parts. Car mechanics will also see their occupations change since EVs with fewer moving parts require less maintenance. For this reason, the map also includes workers on assembly lines who manufacture traditional car engines, gas station attendants, and auto mechanics.

The places most dependent on fossil fuels for local wages concentrate in the Gulf Coast, Appalachia, New Mexico, and the Rocky Mountains. Employment in gasoline engine manufacturing predominates in the Industrial Midwest, but there are also pockets of activity in the Southeast. These are the communities on the front lines of the energy transition. They have also been on the front lines of exposure to pollution from fossil fuel-powered industries.

This map also highlights the uneven economic effects of the energy transition throughout the country.[9] Carbon-intensive industries concentrate in regions rather than being diffuse, and extractive industries, in particular, are often in rural areas. As the energy transition accelerates, the economic prospects of these communities will increasingly diverge from their less carbon-intensive counterparts. Industrial areas have already seen this divergence before with the impacts of trade, offshoring, and automation (Broz, Frieden, and Weymouth, 2021), and with devastating consequences that have fueled resentment of more economically resilient cities.

This map is also incomplete in three consequential ways.

Wide-Ranging Effects

First, the energy transition will touch many more occupations and industries than the map depicts. For example, agricultural regions will

[8] Annual wage data from the 2020 County Business Patterns (CBP) survey.
[9] See Rickard (2020) for a review of the importance of economic geography.