The Economics of Decarbonizing Industrial Production
Research Conference – Cambridge, MA – September 21-22, 2023

Measuring the Clean Energy Transition and its Distributional Impacts

Jonathan Colmer (University of Virginia), Eva Lyubich (U.S. Census Bureau) and John Voorheis (U.S. Census Bureau)

Over the past two decades, the US has experienced a partial energy transition: the share of primary energy coming from coal has declined, while natural gas and zero carbon energy sources such as solar and wind have increased dramatically. Federal and state regulations such as the Inflation Reduction Act and state-level net-zero emissions targets and bans on selling new internal combustion engine vehicles are likely to accelerate the clean transition. Deeper decarbonization beyond electricity generation and transportation will require further adjustments either through the entry of new ventures focused on decarbonization of industry and other sectors, or as incumbent firms reorganize production in less carbon-intensive ways. In addition to directly impacting primary energy sources and carbon emissions, the clean transition also has meaningful implications for environmental justice and the distribution of economic well-being, as it induces a shift in labor demand across industries and geographies and as local co-pollutants adjust in response to primary energy sources.

To better understand the distributional economic and environmental consequences of the clean energy transition, we are building a new prototype microdata infrastructure. This infrastructure will provide new insights into the clean energy transition as it has been experienced to date, and track key indicators as decarbonization continues. We combine several sources of administrative microdata available in the US Census Bureau to measure transitional. For close to real-time measurement, we use high frequency data from SS-4 applications to capture the universe of newly created businesses. To measure the economic factors, we incorporate annual data on firm employment and revenues from the Census Business Register and Longitudinal Business Database. We link firms to workers (and their wages and demographics) using W-2 data from the IRS and the Longitudinal Employer-Household Database and firms to local residents (and their wages and demographics) using the American Community Survey. To measure environmental factors, we geographically link satellite data, providing high-resolution estimates of air pollution.

One challenge to measuring the clean transition in the industrial sector is that industrial classifications lag the rapid evolution of this sector. To overcome this challenge, we identify firms and establishments engaging in clean transition activities both by using industry classifications for well-established industries and by searching for keywords in firm and establishment descriptions that cover a wide range of more nascent clean transition activities such as those related to energy storage, carbon capture and electric vehicle manufacturing. We thus categorize firms and establishments as those engaged in clean transition activities, those producing or heavily relying on fossil fuels, and others.

We begin our analysis by showing descriptive evidence on trends in new business formation in clean, dirty (incumbent fossil fuel or other polluting industries), and other firms. We also examine the geographic distribution of new clean energy firms, characterizing the demographics of households living close to new clean energy firms, and estimating the propensity of firms to locate in low income communities or communities that have historically been economically reliant on fossil fuels (i.e. "energy communities"), as the Inflation Reduction Act – the largest Federal effort to decarbonize the economy to date – incentivizes clean firm location in these areas. This analysis will provide new facts on the extent to which clean firms had been choosing to locate in these areas prior to the creation of any additional incentives, and will provide early evidence on the effects of these investment incentives.

Next, we study dynamic responses to the clean energy transition. We begin by using the longitudinal business data base to study the growth (measured as employment and revenue) of clean firms. Mirroring the first set of analyses, we study how employment and revenue of clean energy firms evolve in low-income communities and energy communities, and characterize the demographics of households in places with large positive changes. We then study the effect of the clean transition on workers using linked employee-employer data – IRS W-2 data linked to the Census Business Register, and the Longitudinal Employer-Household Database. We present new facts about workers in clean and dirty energy sectors between 2005 and 2019. We show that both clean and dirty energy firms hire a disproportionate share of non-Hispanic white and male workers compared to the working population, that workers rarely move from dirty to clean firms, and that, conditional on education, workers do not earn more in clean firms than in dirty firms. We show that the occupational categories of jobs at clean firms differ notably from occupations at dirty firms and tend to be performed by workers with higher levels of education, indicating that skill-mismatch may be a substantial barrier to entry for legacy workers, even when there is geographic overlap in clean and dirty activities. Substantially lower earnings outside of the energy sector combined with low mobility between dirty and clean firms suggests that the costs of the clean transition on workers in legacy fossil fuel sectors may be substantial.

Finally, we study the environmental justice implications of the clean transition. Specifically, we measure changes in individuals' exposure to air pollution at home and at their place of work. We compare how residential and workplace pollution exposure changes for individuals living in energy communities or low income communities vs. other areas. Additionally, our infrastructure allows us to consider how residential and workplace pollution exposure changes for individuals who switch to a clean energy related job vs those who stay in an incumbent fossil fuel industry job or those who work in a job unrelated to the clean transition.

Taken together, the results of this project provide new comprehensive evidence on the economic and environmental justice impacts of the clean energy transition. Crucially, our microdata infrastructure allows us to study this question through both a place-based lens, focusing on community-level impacts for investment-targeted communities, and through an individual lens, as we observe firm dynamics and worker transitions and migration. This infrastructure also allows us to measure the clean energy transition as it proceeds and could serve as the basis for regularly produced experimental data products going forward.