



## Perspectives

## Adaptation, culture, and the energy transition in American coal country

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## ABSTRACT

The U.S. coal industry has experienced economic decline over the past several decades, which has resulted in a loss of mining jobs and severe economic hardship in many coal communities. Recent efforts to relax environmental regulations are ostensibly intended to help relieve this hardship and to revitalize this industry. Based on evidence gathered from focus groups and interviews conducted in U.S. coal communities, we argue that coal communities that have experienced mine closures have already begun an economic and social transition, one that is based on reshaping their culture and sense of identity, and false promises to return coal jobs can be destructive to the progress that has been made.

## 1. Introduction

The United States is undergoing an energy transition. An energy transition is marked by a shift from an economic system dependent on one set of resources and technologies to another [1]. In the present case, the shift is from dependence on carbon-intensive energy resources to lower carbon alternatives. While historic energy transitions have often taken up to a century to unfold [2,3], the current U.S. transition is evolving at a relatively rapid pace.

Certain areas and industries may be lost in such a transition [4] and the coal industry has been one of the primary sectors affected adversely. Early signs emerged of coal industry transition and decline [5,6] as recently as two decades ago due to advanced mechanization, declining mining productivity, and environmental regulations [7]. Over the last decade, however, as domestic electricity demand has declined and market substitutes such as natural gas, wind, and solar have dropped in price, the coal industry decline has become precipitous.

Within his first three months in office, President Trump signed a bill to repeal a regulation protecting streams from coal mining waste and an executive order to rescind limits on greenhouse gas (GHG) emissions from existing coal power plants (i.e., the Clean Power Plan), lift potential restrictions on coal mining on federal lands, and remove the mandate to include the social cost of carbon in regulatory benefit-cost analyses. These and other actions fulfilled campaign promises he made to bring back U.S. coal jobs. It is unlikely, however, that these policy changes will drastically affect the country's current energy transition. While environmental regulations have been an important factor in the energy transition, they are not the primary reason for the recent decline

of the coal industry. Thus, proposed efforts to remove environmental regulations, all else constant, will not change the near- or long-term economic trajectories for coal communities.

Based on insights gathered from focus groups in Appalachian coal mining communities and interviews with professionals working within these communities, as conducted in the summer of 2016, we present an argument in this Perspectives article that many within Appalachian coal communities understand that coal is a declining industry, and that it is important to seek out new economic opportunities and redefine their identity. Significant efforts are already underway on both a community and individual level to adapt to these changes, and signaling that coal should remain an important part of the U.S. fabric can impede momentum.

This article stresses the importance of asking questions about the distribution of benefits and burdens resulting from the U.S. energy transition. The article complements a growing literature on the "just" transition, which emphasizes the need for the transition to be experienced equitably across groups and communities [8–11]. The article also underscores the importance of understanding what is transpiring in declining communities, and the manner in which such communities approach or perceive the energy transition.

## 2. Background: the decline of the U.S. coal industry and economic vulnerability

Both U.S. coal mining and electricity production jobs, as well as coal production are declining. Coal mining jobs have decreased approximately 71% since 1985, with an estimated 170,500 jobs in January

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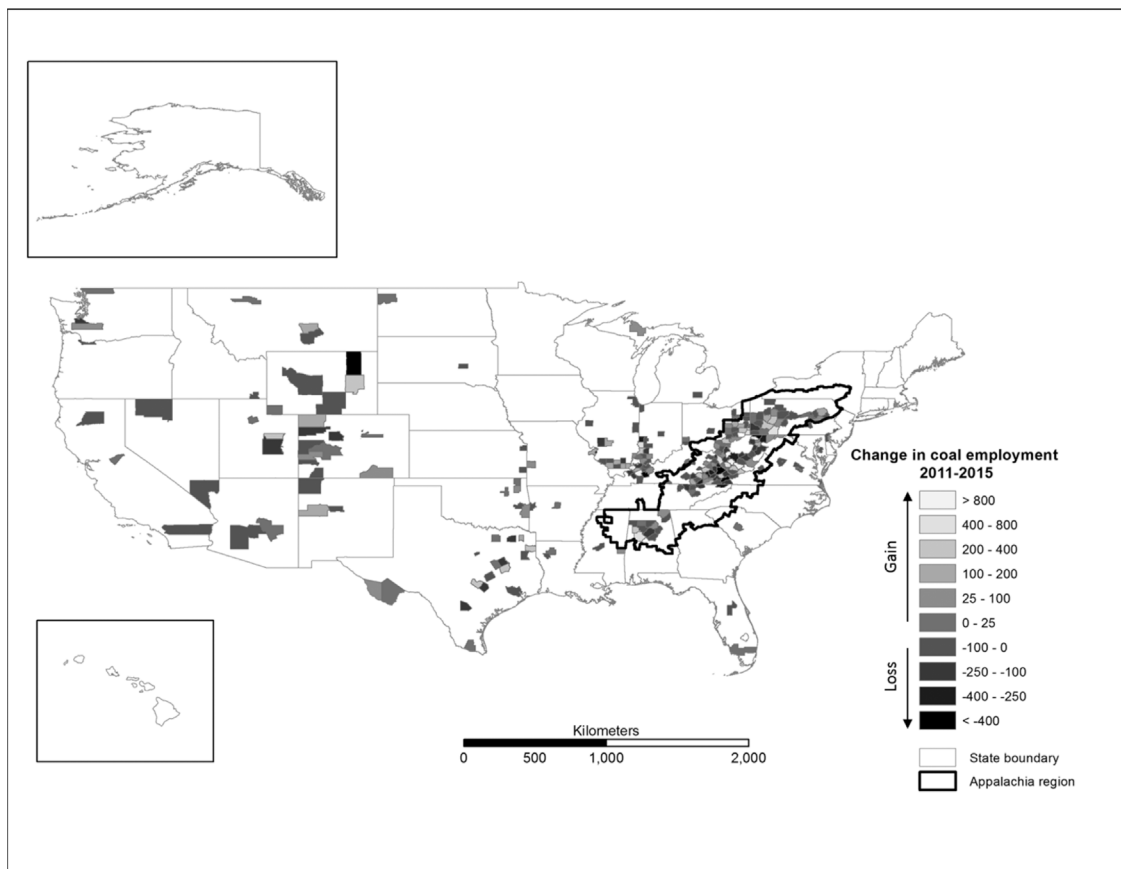


Fig. 1. Change in U.S. Coal Employment between 2011 and 2015.  
Source: [30].

1985, and 50,000 in January 2017 [12]. Coal production peaked in 2011 and has dropped dramatically since then [7]. Fig. 1 displays the difference in coal employment between 2011 and 2015, the most recent year of available data. Despite some gains in jobs in certain counties, this map highlights that Appalachia, the focus of this Perspectives article, was one of the hardest hit regions.

These declining trends are due to a confluence of factors. Among the earlier contributors were (1) rising prices for coal due to declining mining productivity, the need to dig deeper for usable coal deposits, and rising costs of sub-surface coal mining [13,7,14]; (2) the mechanization of coal mining in which, even as production has expanded, technological improvements have led to higher worker productivity and fewer jobs [5]; and (3) environmental regulations [13,14], especially the sulfur dioxide limits in the Clean Air Act of 1990 and the subsequent decline in demand for Appalachia's high-sulfur coal [6]. A recent analysis argued that environmental regulations have played a role in the decline of the coal industry, but that the role has been quite modest relative to other factors. This study estimated that recent environmental regulations only accounted for about 3.5% of the total 33% decline in U.S coal production [15].

Three additional trends have played a particularly important role over the past decade. First, U.S. demand for electricity has been relatively flat since falling drastically at the end of the last decade during the Great Recession. Forecasts suggest that it is not expected to appreciably increase for decades to come [16].

Second, the price of market substitutes has fallen considerably. As a result of the U.S. shale gas revolution, natural gas prices are well below the price per unit of coal across most of the country. The cost of wind and solar generation has also declined significantly due to technological improvements [17] and there is little to suggest that these price trends will change considerably in the future. To illustrate the challenges to

the current U.S. market for coal, Fig. 2 maps counties according to the resource that would produce the lowest levelized cost of electricity (LCOE) in the construction of new power plants based on a set of assumptions available in Rhodes et al. [18]. This map shows that even with a zero social cost of carbon, coal is not economically competitive for electricity applications anywhere in the country. Although an LCOE metric is not the perfect measure to compare across different types of resources—particularly between dispatchable and non-dispatchable resources—nor does it account for the need to have back-up resources for intermittent sources, it provides some evidence about the relative competitiveness of different energy resources.

These price differentials have important implications for utility and infrastructure planning. Electricity investments tend to be long-term, since power plants are built to last 30–40 years. As utilities and power producers invest in new facilities, they will weigh the cost of different energy resources, both present and based on future projections. As of January 2017, out of the approximately 110,000 MW capacity that is under development or planned through 2027, approximately one percent is coal. Meanwhile, between 2012 and 2015 alone, 34,000 MW of coal-fired power generation capacity went offline [19].

Third, many countries are adopting low-carbon alternatives and have committed to the Paris Climate Agreement, as displayed in Fig. 3. Although the President Trump has declared his intention to withdraw the United States from the agreement, many U.S. state and local governments have noted their continued commitment to renewable energy development and GHG abatement. A large number of other countries have also committed internally to the pursuit of renewable energy through renewable portfolio standards and feed-in tariffs [20]. Canada and Finland have banned coal generation by specific target years and all EU countries save Greece and Poland have committed to no more new coal power plants after 2020. The International Energy Agency

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