Sharing the Cost of a Wildfire-Resilient Grid

Line A. Roald

Department of Electrical and Computer Engineering, University of Wisconsin – Madison, 1415 Engineering Drive, Madison, 53706, Wisconsin, United States.

Contributing authors: roald@wisc.edu;

Abstract

Preparing the electric grid to withstand adverse impacts from climate change will require significant investments. How the cost of such investments is shared has important implications on affordability and equity in electricity access, as demonstrated by a recently published paper focused on wildfire risk mitigation in California.

Keywords: Electricity access, climate change, wildfire risk mitigation, equity, affordability

As climate change unfolds, the electric grid is experiencing a twofold challenge. On the one hand, the grid plays an important role as an enabler of renewable energy generation and efforts to electrify, and thus reduce emissions, from sectors such as heating and transportation. On the other hand, the electric grid itself is vulnerable to changing and more extreme weather patterns, and has to adapt to increasing threats such as heat waves, flooding and increased wildfire risk [1]. Reducing emissions while maintaining reliable access to electricity will likely require significant investments in grid infrastructure. The question of where to invest, as well as how to allocate the cost of these investments have profound impacts on affordability of electricity and may exacerbate or reduce existing inequities in grid access. In a new contribution in Nature Energy [2], Zhechen Wang and co-authors at Stanford University investigate these important questions in the context of wildfire risk mitigation in California.

In their paper, the authors first investigate current wildfire vulnerabilities in the grid. Leveraging a combination of publicly available data and advanced machine learning tools, they assess several metrics for wildfire risk and community preparedness including the share of overhead power lines in close proximity to trees and the fraction power lines buried underground. Higher shares of power lines near trees increases the risk of adverse wildfire-grid interactions, as power lines may ignite fires when they come in contact with nearby vegetation and burning vegetation can cause damage to nearby power lines by exposing them to heat, smoke and flames. Conversely, higher fraction of undergrounded lines decreases risk, as burying power lines is one of the most effective, but also most expensive, methods for avoiding wildfire-grid interactions.

The authors categorize communities based on wildfire risk level (high, medium and low) and median income. Their results show that communities with high wildfire risk and low median income have a higher fraction of overhead power lines in close proximity to trees and a lower fraction of power lines buried underground compared to higher income communities with similar risk. The prevalence of high risk power lines in low-income communities translates into a significantly higher per-household cost for mitigation projects, precisely in the communities that are least able to bear the cost.

Given these findings, the authors discuss the different ways in which undergrounding projects could be financed. Currently, grid infrastructure investments are either funded by the local community where the project is taking place, or are socialized (i.e. shared) across all customers in the grid through an increase in electricity rates. Increases in rates across all customers have to be reviewed by the California public service commission, who have traditionally not considered wildfire risk mitigation as a valid reason for socializing the cost of grid investments, though this may be changing [3]. In their paper, the authors assess the impact of local or socialized cost allocation schemes on different groups of customers, and propose a hybrid scheme.

First, the authors make a case for allowing electric utilities to socialize at least some of the cost of undergrounding across all customers in the grid. However, the data provided by the authors show that communities with higher wildfire risk tend to have a higher median income, and that a disproportionately large share of the wealthiest communities reside in areas with high risk. Thus, if all high-risk communities are allowed to socialize the cost of undergrounding the lines, a disproportionate share of the money raised across all income groups may be used for projects in wealthy communities. Furthermore, if all costs were socialized, the impact on utility bills might be large enough make electricity unaffordable for many customers and could cause a backlash among the customers residing in low- and medium-risk areas.

To achieve more equitable outcome, the authors propose a new hybrid cost allocation scheme which uses median income in an area to determine whether the cost of undergrounding should be socialized across all customers or paid locally by the community. The challenge of designing such a scheme is to define the income threshold below which the community is eligible to socialize costs. The authors point out that identifying this level requires balancing two competing objectives. First, a higher threshold will lead to a larger socialized cost, which will increase electric utility bills for all customers – including the ones with the lowest income. This suggests that it is better to choose a low threshold which only socializes the cost of the lowest income communities. Second, communities above the threshold will by definition be required to pay their own undergrounding cost. Thus, the threshold must be high enough to avoid that some communities are left unable to mitigate wildfire risk. After experimenting with different income thresholds, the authors recommend socializing the cost of undergrounding only in communities with a median household income of $100,000 or less. This threshold ensures that all communities pay the most equal – and lowest – share of household income towards undergrounding projects. The analysis also demonstrates that the two extremes, when all costs are either socialized or paid locally, both produce highly regressive results where lower income communities pay a substantially higher share of their income towards undergrounding projects.

The presented study complements other research on equity in energy access, such as assessments of inequities in grid access for distributed energy resources in California [4], or more generally, how to optimally plan a future energy system with equity in mind [5]. It is also very timely, as the California utility PG&E is currently proposing to bury 10,000 miles of lines underground and socialize the cost [3]. If approved, this will add an estimated 18% to the utility bills for the company's customers [6]. Where exactly investments would be made, and which communities would benefit remains to be seen. This new research can provide important pointers for how to invest for maximum benefit.

Overall, the study highlights the challenging trade-offs and staggering costs involved in adapting the grid to climate change. Importantly, it serves as a reminder that affordability is as important as resiliency and reliability of the grid. There is little point in having reliable electricity service if you cannot afford to use it.

References

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