Policy Considerations for Adapting Power Systems to Climate Change

Risks of maladaptation, efforts to integrate local knowledge, and considerations for other policy priorities will help ensure a more robust adaptation process for power systems. Existing modeling tools can be used to provide an assessment of adaptation measures that moves toward incorporating these insights, although future work is still necessary to incorporate factors like cost and risks for imposition of path-dependency.

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I. Introduction

A growing number of authoritative sources have highlighted the importance of considering climate change risks to energy systems. Multiple academic, government, and industry researchers have conducted studies identifying in particular the risks to electric power systems that come from extreme temperatures, sudden and severe weather, and changes in precipitation. Each of these phenomena jeopardize the ability of power systems to balance demand and supply in multiple ways – from creating uncertainty around what levels of system capacity should be built to obstructing the delivery of coal fuels by river barge (Rothstein and Parey, 2011; Dell et al., 2014; Scott and Huang, 2007; Bull et al., 2007; Zamuda et al., 2013; DNV-GL, 2014). Necessarily, these risks imply a need for risk

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mitigation – that is, for adapting power systems to climate change.

Though interest in climate change adaptation of power systems is growing, much of the deliberation over how to adapt power systems has focused upon large-scale investments in relatively fixed capital. Moreover, there does not seem to be much borrowing from adaptation experiences within other sectors and other parts of the world that have been dealing with climate change risks for years, such as water management. The utility responses to Superstorm Sandy provide a good example of this status quo. In the wake of the storm, many of the responses proposed by utilities revolved around so-called ''grid hardening'' plans; these plans involved relocation, reinforcement, and embellishment of existing infrastructure, at steep costs to the utility and ultimately the ratepayers. While such measures certainly have their merits and in some cases addressed long-standing climate vulnerabilities within the existing power system infrastructure, the plans seemed to give little credit or attention to alternative measures that had played major roles in resilience to the storm such as combined-heat-and-power units (Lacey, 2014). Similar thinking has been applied in the case of other energy networks, particularly natural gas, in which the recommended resilience strategy has been to vertically integrate and increase the density of natural gas pipeline networks (Evans and Farina, 2013).

This article attempts to broaden the discourse around climate adaptation options for the U.S. power sector by presenting insights on climate change adaptation from other sectors and other parts of the world, and by demonstrating via a preliminary analysis ways in which those insights might be integrated into assessments of adaptation measures. This article provides a literature review that derives key points of guidance for climate adaptation generally, and uses a computable general equilibrium tool to illustrate how those insights might be used. Suggestions are made at the end of the article for further research into using these insights in decisions on how to adapt power systems to climate change.

The discourse around climate adaptation options for the U.S. power sector can be broadened by presenting insights on climate change adaptation from other sectors and other parts of the world.

II. Lessons from Climate Adaptation Literature

Despite there being a great deal of promise in the suggestions dominating the industry discourse on adapting power systems to climate change, research in other areas of climate change adaptation reveals key insights that do not yet appear to have found a strong voice. The focus upon major infrastructure investments held by industry practitioners in the adaptation space obscures a myriad of alternatives that have found use in other domains of climate adaptation. Distributed resources, for example, are considered to be a ''relatively small'' component of the power sectors' adaptation approach by some utility executives (Lacey, 2014). By contrast, distributed water resources have found to be critical in adaptation to drought conditions in some parts of the world (Laves et al., 2014). In this section, we explore some of these insights and conclude with key takeaways for those researching climate adaptation policies and practices for the power sector.

A. Considering potentials for maladaptation

While certain measures may appear to provide a way to adapt to climate change, these measures can sometimes exacerbate vulnerabilities and risks from climate change in unforeseen ways. This unintended exacerbation is referred to as ''maladaptation.'' Maladaptation can occur in a wide variety of ways; Barnett and O'Neill (2010) provide a useful typology of

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