Facilitating Transmission Expansion to Support Efficient Decarbonization of the Electricity Sector

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1. Motivations underlying the research

Over at least the next 30 years, achieving deep decarbonization targets for most electricity sectors will require replacing the bulk of fossil-fueled generators with zero carbon wind and solar generation along with energy storage. The best wind and solar resources are located in geographic areas that are often relatively far from the locations of the legacy stock of generating plants, their supporting transmission infrastructure, and load centers. This situation raises a number of important questions. How much additional transmission capacity is needed efficiently to access these locations and utilize efficiently the wind and solar capacity that can be developed there? What are the barriers to facilitating the development of this transmission capacity? What changes in the approaches to stakeholder engagement, planning, regulatory, and financing arrangements can help to reduce these barriers? What can we learn from best practices in the U.S. and Europe to reduce these barriers?

2. Summary of research

The research documents that the best wind and solar resources in the U.S., the EU, and China tend to be remote from the existing stock of generating plants, remote from their supporting transmission infrastructure, and remote of demand centers. It goes on to examine several recent studies that use optimal electric power system planning models to identify transmission expansion needs in the U.S. and Europe efficiently to support deep decarbonization targets. While the results necessarily vary across model assessments, they all support the conclusion that significant transmission expansion is necessary to meet decarbonization targets efficiently.

We find that in both the U.S. and Europe transmission expansion is proceeding more slowly than would be desirable. The research starts with several case studies of several major transmission projects in the U.S and Europe, to help to identify the barriers these projects faced, and how the developers ultimately overcame the barriers or abandon the projects. These case studies are supplemented with a review of more recent planning, investment and regulatory experience in the U.S. and Europe, including the impacts of FERC Order 1000 and the EU Regulation on Trans-European Energy Networks (TEN-E). Comparing and contrasting U.S. and European responses to similar challenges yields useful suggestions for organizational, regulatory, planning, compensation and cost allocation reforms that can reduce the barriers to efficient expansion of transmission capacity.

The first barrier arises due to the limited geographic areas over which transmission planning has typically taken place. The EU has developed better institutions to identify attractive transmission projects over a large geographic area that encompasses the best wind and solar sites. The most important EU institution is ENTSO-E which serves, among other things, as an umbrella planning organization covering all of the transmission system operators (TSO) in the European synchronous network and neighboring grids. This leads to the recommendation that the U.S. (or the U.S. plus Canada) create a similar umbrella planning institution to facilitate interregional planning over much larger geographic regions than is the case today.

The second barrier, primarily in the U.S., is the failure to take all benefits of transmission expansion into account, especially decarbonization benefits. The U.S. lacks a comprehensive national decarbonization policy and some states have aggressive decarbonization commitments while others do not. Again,

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the EU has adopted detailed guidance for comprehensive cost-benefit analysis that include decarbonization commitments.

The third barrier arises due to the ways in which transmission developers are compensated for their transmission investments, increasing financing and project development costs. Three general compensation models are discussed along with their strengths and weaknesses. Actual transmission compensation practices in the U.S., the UK and the EU are then discussed. The research concludes that a hybrid compensation model, that integrates incentive regulation and competitive procurement with cost- of-service regulation is likely to reduce transmission development costs, while accommodating merchant projects more effectively.

The final barrier is opposition by stakeholder groups, going beyond classical NIMBY opposition. Drawing on the case studies and the literature on siting major infrastructure projects, the research identifies several actions that should be taken to better engage with stakeholders.