ANALYSIS OF COMMISSIONING TIMELINES OF RENEWABLE ENERGY PROJECTS

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Overview

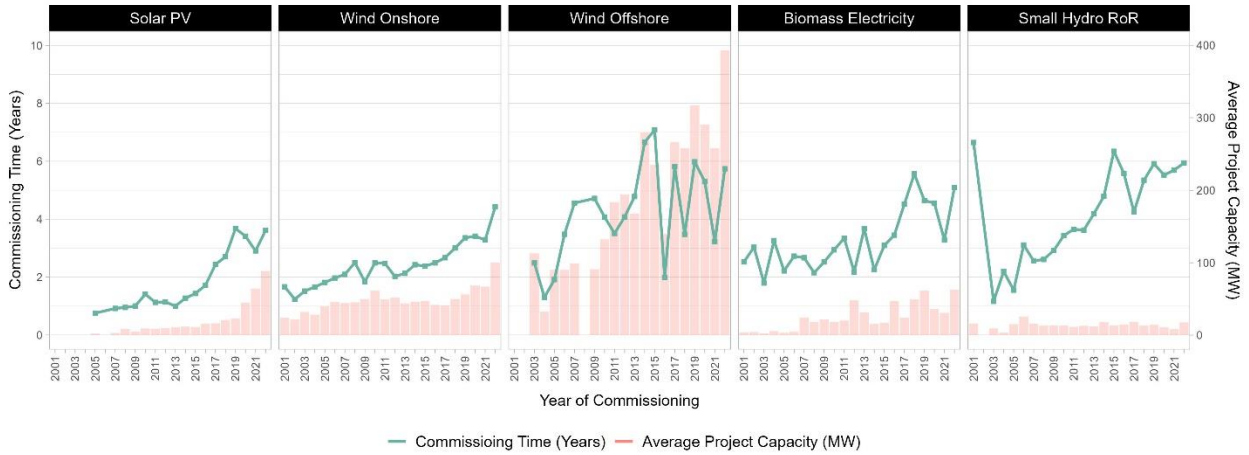
Despite increased technology maturity and dramatically decreased costs, the deployment momentum of renewables lacks behind ambitious policy commitments in many countries (IRENA, 2022). Yet, the centrality of renewable energy technologies in replacing polluting fossil technologies has increased in many country's decarbonization plans (Klaaßen & Steffen, 2023). Accordingly, policymakers must accelerate the development of renewable energy projects. However, a comprehensive understanding of how long projects take to commission (time between commissioning and permitting) is lacking and which factors affect project commissioning times is also lacking. The paper analyzes commissioning times between 2001 and 2022 for 12,642 renewable energy projects across the globe for solar PV, wind onshore, wind offshore, biomass electricity, and run off the river hydro.

Methods

We conduct descriptive analysis to understand the evoluation of commissioning times across technology and countries between 2001 and 2022, and ordinary least squared regression analysis on factors that affect commissioning time for renewable energy projects. We define five factors that affect commissioning times, namely project size, technology characteristics, project structure and actors characteristics, project site characteristics, and market characteristics. Project structure and actor characteristics are bifurcated into financial and legal structure characteristics that define the contractual nature of the project, and developer characteristics that define ability of those developing the project. Likewise, market characteristics are bifurcated into economic characteristics and policy and governance characteristics. To arrive at these factors, we draw on renewable energy policy literature discussing factors that affect construction timelines of projects (Moreira et al., 2013). We complement this review with literature on construction delays in sectors ranging from real estate (Lo et al., 2006), transport (Flyvbjerg et al., 2004), energy (Ansar et al., 2014; Diniz et al., 2023), and others. In addition, we also review literature on the cost of capital of renewable energy technologies (Steffen, 2020) and the literature on project and developer risks (Lüthi & Prässler, 2011; Mizuno, 2014).

Results

We find that renewable energy projects commissioning time has increased over the last two decades with the exception of wind offshore (see figure). We also find that project size, project structures, developer experience, feeder infrastructure availability, foreign exchange rate stability, and policy support are factors that influence commissioning time.



Conclusions

Our finding has implications for policymakers, businesses, and researchers. Policymakers can undertake steps to foster experience built-up among a higher number of developers, for instance by using public procurement as a tool for promoting new developers or ensuring adequate competition in the market. They can also help standardize financial and legal contracts, project documents, and legal processes to accelerate deployment. Finally, a higher overall government effectiveness can contribute to reducing implementation bottlenecks.

For businesses undertaking development or construction of renewable energy projects, our finding suggest that experience and commitment to the project matter. While we analyze endogenously built experience prior to a project, businesses wishing to enter the renewable energy business can overcome lack of experience by hiring experienced employees or entering into partnership with established firms for obtaining knowledge transfers.

For researchers, the finding foremost suggest that electricity market models delineating energy transition pathways should consider updating commissioning times in their models to technology specific times as those presenting in this research. Considering otherwise can results in optimistic pathways which policymakers may not be able to achieve. The finding also suggest that researchers should include such technology specific lead times in their techno-economic or feasibility analysis as discounting cashflows by one more year can yield significant change in investment decisions.

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