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The Value Of Timing: Optimal Contract Design Under Divergent Discount Rates

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Extended Abstract

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Abstract Summary

Investment in capital-intensive, long-lived energy assets is constrained in competitive electricity markets, in part due to differences between private and social discount rates. Private investors apply higher financing based discount rates that emphasize near term returns, while public actors apply lower social discount rates that place greater weight on long term outcomes. As a result, identical cash, cost and energy streams are valued differently, and projects with positive public value may not appear privately viable.

This paper examines whether payment timing can be used as a design variable to align private investment incentives with public cost objectives. A stylized project-level linear program is developed with two parties: a private actor (investor) and a public actor (society). The model evaluates contracts composed of investment credits, production credits, and downward adjusted electricity prices applied in later years representing electricity sold to the public actor below the exogenous market price. The objective is to minimize the public's discounted cost subject to private viability and a public cost benchmark based on market procurement.

Results show that combining early period support with later price reductions can make projects privately viable while reducing the public's discounted cost relative to purchasing electricity at the market price. This outcome arises because the private actor places greater value on earlier payments, while the public places greater value on larger future price reductions under a lower discount rate. The model characterizes a feasible set of contracts and an efficient frontier describing the minimum support required for private viability at different levels of price adjustment.

The effect is strongest for capital-intensive, long-lived assets, where longer time horizons amplify differences in discounting. While the analysis is stylized, the results suggest that

intertemporal payment design may be a useful consideration in energy policy and subsidy design, warranting further study in more realistic settings.

Presenting Author Biography

Levi M. Larsen is a PhD candidate at the Norwegian University of Science and Technology in electric power engineering. His current research focuses on market design for decarbonized systems. He has worked as an energy economist at Idaho National Laboratory and held prior roles in industry, including at Thermo Fisher Scientific and Goldman Sachs. Levi has contributed to policy-relevant research on nuclear energy and power markets and regularly engages with academic and industry audiences through conferences, publications, and applied consulting work.