

In Partial Fulfillment of the Requirements for the Degree of

Master of Science
Robert Meyers

Will defend his thesis

A Model for Estimating Emissions and Costs of Competing Energy Systems: Dynamic Scenarios of Photovoltaic Rollout in the US

Abstract

A model is developed to explore several scenarios of future polysilicon photovoltaic (PV) capacity rollout in the US within the context of the larger global PV rollout predicted over the coming decades. The model provides a target for cumulative rollout using currently accepted projections, then uses a lifecycle assessment (LCA) methodology to derive initial costs and emissions, and then evolves these costs and emissions over a twenty year period from 2010 to 2030 using both an asymptotic price experience curve and a newly devised asymptotic carbon intensity experience curve. Rollout of PV is compared to an equivalent rollout of coal in every model year. Life cycle emissions of polysilicon PV are 52 g CO₂/kWh in 2010 and decrease to 33 g CO₂/kWh by 2030. Minimum carbon tax prices necessary for coal and PV cost parity are derived for every model year. Cost parity in terms of \$/Wp of new capacity is reached between 2013 and 2016 without any taxes, but parity in \$/kWh in these years requires a carbon tax of between \$43.60/ton and \$60/ton in constant 2010\$. A delayed rollout that free rides on the efforts of the rest of the world is determined to be the most cost effective strategy for the US, but limitations in the model and concerns about international reactions to this strategy could make it difficult or undesirable to pursue. The US would give up any benefits from the domestic development and production of this major future technology. And given the size of its economy, free riding on the part of the US may encourage free riding among other nations as well. A slow rollout may not be practical or in the best interests of the US

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Faculty, students, and the general public are invited.

Supervisory Committee:
Dr. Eric Williams (Chair)
Dr. Joshua Abbott (Member)
Dr. Braden Allenby (Member)