Green roofs and rooftop-mounted solar PV arrays have a wide range of environmental and economic benefits, including significantly longer roof lifetimes, reductions in urban runoff, mitigations in the urban heat island (UHI) effect, reduced electricity demand, and/or reduced emissions of greenhouse gases (GHGs) and other harmful pollutants from the electricity generation sector. Consequently, green roofs and solar panels have both become increasingly popular worldwide, and promising new research has emerged for their potential combination in Green Roof Integrated Photovoltaic (GRIPV) roofing applications. However, these alternatives still have marginal market shares in the U.S., while GRIPV research and development is still severely limited today. As a result, these options are not yet sufficiently widespread in the United States as to realize their full potential, particularly due to a variety of policy resistance effects with respect to each specific alternative.

The steps in the System Dynamics (SD) methodology to be used in this study are summarized as follows. First, based on a comprehensive review of relevant literature, a causal loop diagram (CLD) will be drawn to provide a conceptual illustration of the modeled system. Second, based on the feedback relationships observed in this CLD, a stock–flow diagram (SFD) will be developed to form a quantitative model. Third, the modeled SFD will be tested thoroughly to ensure its structural and behavioral validity with respect to the modeled system in reality using whatever real world data is available. Fourth, different policy scenarios will be simulated within the model to evaluate their long-term effectiveness. Fifth, a sensitivity analysis will be performed to evaluate the inherent uncertainties associated with the analyses in this study. Finally, the results observed for the analyses in this study and possible future research steps will be discussed and compared as appropriate.

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Approved for distribution by Omer Tatari, Committee Chair, on March 16, 2018.

The public is welcome to attend.