SCHOOL of SUSTAINABILITY
ARIZONA STATE UNIVERSITY

In Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

Jin Ho Jo

Will defend his dissertation

An Empirical and Optimization Modeling Approach to Achieve Urban Energy Sustainability: Cool Roof and Building Integrated Photovoltaic Systems

Abstract

Major cities have a significant impact on global and regional climate change due to their rapid population growth and the physical expansion of the metro region, both of which result in intensive material and energy consumption. The urban built environment has evolved as a result of a number of social and economic processes that are central to sustainable development. This study focuses on ways to achieve a more sustainable built environment through urban energy system interactions. A systems approach was applied to develop the Sustainable Urban Systems Framework as a way to provide new insights and serve as a valuable tool to assess complex urban systems at different scales. While there is extensive literature on microscale intervention and mitigation strategies, the regional influence of these strategies is not yet well understood for complex urban systems. Understanding the implications and impacts of intervention strategies is a critical step towards addressing sustainability issues due to complex building interactions involving electricity, water and climate change in the broader context of urban systems. Although Arizona has the largest annual average solar radiation in the US, several factors have limited the use of solar technologies, including the low cost of fossil fuels, high cost of solar power generation systems, and insufficient tools to assess the potential of the urban scale applications. This research used empirical and modeled studies at both the building and urban scales to examine the direct and indirect benefits of cool roof technology and building integrated photovoltaic system applications as mitigation strategies to create sustainable urban energy systems that have the potential to satisfy Arizona's Renewable Energy Standard electricity generation requirement. This study examined how optimization and broader urban scale implementation of mitigation strategies can enable urban areas to evolve without accumulating additional energy intensity from conventional fossil fuel

sources while at the same time addressing other sustainability imperatives such as greenhouse-gas emissions and water consumption. The new model proposed here will help policy makers at the city government level and in utility companies to implement sustainable technologies at both the building and urban scales by providing novel methodological approaches.

April 19, 2010
9:30 AM
Decision Theater Executive Conference Room
21 E. Sixth Street, Tempe, AZ 85287

Faculty, students, and the general public are invited.

Supervisory Committee:
Dr. Jay S. Golden (Chair)
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