Environmental Science Seminar

School of Public and Environmental Affairs

Thursday, February 2nd at 4:00 p.m. in SPEA Rm 278

Presentation by:

Deepak Sivaraman, Ph.D.

Candidate for the Industrial Ecology/Life Cycle Analysis Faculty Position in the School of Public and Environmental Affairs

Methodologies to Accurately Estimate and Guide Carbon Abatement Using Renewable Installations in the US: Applied to Grid Connected Photovoltaics

Abstract: Photovoltaic (PV) electricity has significant potential to mitigate CO_2 emissions from the grid. Conventionally, the CO_2 abatement capacity of renewable installations is estimated by combining the renewable generation in conjunction with the average CO_2 intensity of the electricity grid. In this study, a methodology to more accurately evaluate CO_2 abatement by PV electricity is developed. A capacity factor based electricity dispatching model is developed to evaluate marginal abatement in the load zones of Texas (Electric Reliability Council of Texas, ERCOT) and California (California Independent System Operator, CAISO), and it is compared to the abatement using national, regional and state average fuel mix resource profiles. The average fuel mix cases over-estimated and under-estimated CO_2 abatement in Texas and California, respectively. Marginal abatement was lower by 17% than the average cases in Texas, due to the predominant displacement of the low carbon natural gas plants at the margin. In California, marginal abatement was higher (1.3 to 2.4 times) than that of the average cases due to the displacement of highly inefficient gas plants at the margin. This model demonstrates that the CO_2 abatement of PV electricity is dependent on peak load resources, turbine characteristics and capacity of installations. Subsequently, a CO_2 indicator that can be used as a guideline for selecting PV installation sites to derive maximum abatement is developed. Installing photovoltaics in regional areas of MRO, SPP and RFC (different electricity regions within the US) was determined to be most beneficial. The results of this study can guide energy planning and CO_2 mitigation policy-making using photovoltaics in the future. In general, this methodological framework can be extended to accurately estimate the CO_2 abatement capacity of different types of renewable installations in the future.

Bio: Deepak Sivaraman received his PhD in Energy and Electricity Systems from University of Michigan, Ann Arbor in 2009. His focus was in the fields of applied life cycle engineering and industrial ecology, and he received the “3M Outstanding Industrial Ecologist” award in 2008. He has an engineering economics background and holds master’s degrees in both Environmental Engineering and Applied Economics. Upon graduation he took a postdoctoral (*Research Fellow*) position in the Centre for Design (CfD) in the Melbourne Institute of Technology (RMIT University) in Australia. His research is published in journals such as Journal of Industrial Ecology, Energy Policy and Environmental Engineering Science.