ASU SCHOOL of SUSTAINABILITY

ARIZONA STATE UNIVERSITY

In Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

Mindy Kimball

Will defend her dissertation

Automobile Path Dependence in Phoenix: Driving Sustainability by Getting Off of the Pavement and Out of the Car

Abstract

A methodology is developed that integrates institutional analysis with Life Cycle Assessment (LCA) to identify and overcome barriers to sustainability transitions and to bridge the gap between environmental practitioners and decisionmakers. LCA results are rarely joined with analyses of the social systems that control or influence decisionmaking and policies. As a result, LCA conclusions generally lack information about who or what controls different parts of the system, where and when the processes' environmental decision making happens, and what aspects of the system (i.e. a policy or regulatory requirement) would have to change to enable lower environmental impact futures.

The value of the combined institutional analysis and LCA (the IA-LCA) is demonstrated using a case study of passenger transportation in the Phoenix, Arizona metropolitan area. A retrospective LCA is developed to estimate how roadway investment has enabled personal vehicle travel and its associated energy, environmental, and economic effects. Using regional travel forecasts, a prospective life-cycle inventory is developed. Alternative trajectories are modeled to reveal future "savings" from reduced roadway construction and vehicle travel. An institutional analysis matches the LCA results with the specific institutions, players, and policies that should be targeted to enable transitions to these alternative futures.

The results show that energy, economic, and environmental benefits from changes in passenger transportation systems are possible, but vary significantly depending on the timing of the interventions. Transition strategies aimed at the most optimistic benefits should include 1) significant land-use planning initiatives at the local and regional level to incentivize transit-oriented development infill and urban densification, 2) changes to state or federal gasoline taxes, 3) enacting a price on carbon, and 4) nearly doubling vehicle fuel efficiency together with greater market

penetration of alternative fuel vehicles. This aggressive trajectory could decrease the 2050 energy consumption to 1995 levels, greenhouse gas emissions to 1995, particulate emissions to 2006, and smog-forming emissions to 1972. The potential benefits and costs are both private and public, and the results vary when transition strategies are applied in different spatial and temporal patterns.

The current state of LCA and environmental assessment operates without much discussion of who can make the improvements happen. The IA-LCA expands traditional frameworks by combining empirical research with institutional insights to facilitate comprehensive long-term decision-making and planning in metropolitan areas while also revealing unintended consequences and hidden benefits. The theoretical contribution of this research is in showing a city or region that achieving more sustainable transportation systems is not just about transit-oriented development, but it is so much more and reaches across spatial, temporal, and institutional divides.

Tuesday, April 15, 2014
10:30 a.m.
Wrigley Hall, Room 481

Faculty, students, and the general public are invited.

Supervisory Committee:

Dr. Mikhail Chester (Chair)
Dr. Braden Allenby (Member)
Dr. Aaron Golub (Member)