

Energy and Resources Group Spring 2009 Colloquium Series (ER295)

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**Understanding the Importance of an Energy Crisis -
US CAFE Regulation and Human Development Impacts in Uganda**

110 Barrows Hall / 4:00 p.m.

Today, the United States faces the daunting task of gripping an impending energy crisis and transforming society with a sustainable energy revolution. In the late 1970s, the United States made dramatic policy-based choices to avoid another oil crisis. However, our energy infrastructure has changed and upgraded little, setting the stage for a future energy crisis. In Uganda, people face daily energy crises in their businesses, schools, and hospitals. Due to these events, energy solutions are diverse and decentralized. Considering these two situations, my unified approach informs policy for a wide array of energy systems. Understanding the political and community-based choices and solutions during an energy crisis engages energy system analysis in terms of policy and model assumptions.

Part 1: Whether society chooses energy security or climate change as its motivation, the level of United States motor gasoline consumption and its current growth rate must change drastically. Models for calculating light duty vehicle's fuel economy incorporate many vehicle-based parameters: 20 to 200, with some being proprietary and challenging for policy makers to acquire or use. This presentation briefly describes a MatLab-based simulation model, MINPAR, which uses the three critical vehicle-based parameters: mass, engine size, and transmission characteristic. It is used to model over one thousand 1986 and 2004 United States offered vehicles from the EPA Test Car list (cars and light trucks) and four hundred 2004 Japanese offered vehicles' fuel economy (FE). Offered vehicles consist of vehicle models and their different configurations. Status-quo vehicles are defined as offered vehicles modeled well with MINPAR by comparing modeled to measured fuel economies. Status-quo vehicles are modeled accurately and represent over 95% sales. Niche vehicles are defined using an easily understood and interpreted percent error methodology. Physically-defined niche vehicle configurations mirror economic realities of niche markets (5% of total final sales market). By separating the high FE versus extreme power niche vehicle designs, a pattern emerges between (1) US 1986 versus 2004 and (2) US 2004 versus Japan 2004. By analyzing the status-quo vehicles, the US can reach 35 mpg target without niche technology designs, but can reach 45 mpg by implementing a close cousin to the Japanese Kei vehicle. Through Japanese policy, five of the top ten vehicle sellers in Japan are high fuel economic Kei cars and trucks. However, it is hypothesized that the US will not decrease gasoline consumption with the Reformed CAFE regulation, specifically, and without an energy or oil crisis, generally.

Part 2: Human development and electrical energy co-exist seamlessly in high HDI countries where reliability and availability are greater than 99%. In numerous low HDI countries, there is 2-50% electric grid *availability* with *reliability* at or below 50%, due to load shedding and faults. In Africa, solar, wind, biomass and hydroelectric energy production are cited by researchers to meet growing demand and increasing reliability with all imported technology. However, locally designed and built energy-producing devices can meet unique energy crisis situations. For example, human power implemented in Uganda would at least double the energy production capacity of the Ugandan electric grid. Merry-go-round generators at hospitals and schools meet lighting energy demands. Bicycle generators at businesses and village homes meet audio-visual and telecommunication demands from personal exercise routines. This is only one component of a three-tier empowerment research methodology for locals to co-create community-based solutions for electrical energy availability and an increase in the reliability of energy. This methodology then combines with power load and weather monitoring to generate potential policy pathways for the Ugandan government to decrease energy crisis events (in number and level).