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Energy engenderment: An industrialized perspective assessing the importance of engaging women in residential energy consumption management

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HIGHLIGHTS

- Role of women in energy consumption is understudied in industrial settings.
- There is a significant impact from women on energy consumption in test case.
- Higher per capita, per square foot, and gas consumption are indicated for women.
- Women's intrinsic role at household level can allow for better energy efficiency.

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ABSTRACT

This study assesses gender role and participation in energy utilization at the residential household level in an advanced industrial country setting. Two hundred and twenty one (221) standardized surveys of single-family residential households in San Antonio, Texas – the seventh largest city in the United States of America – are collected and used as a test case. The objective is to highlight the role of women in improving household energy efficiency. By coupling the behavioral and analytical sciences, studies such as this one provide better insight for the effective deployment of targeted energy efficiency programs that can benefit both households and municipalities while reducing impact on environmental resources. Study conclusions highlight 80% higher per capita consumption in female dominant households versus male dominant households ($p=0.000$) driven by approximately double the gas consumption in female-headed households ($p=0.002$), and 54% more electric usage ($p=0.004$). The higher use in female dominant homes is examined through the socio-demographic impacts of education, income, vintage of home occupied and size of home occupied. The theoretical framework and test case presented in this study promote the need for market segmented energy efficiency initiatives that better engage women in energy demand-side management in industrialized populated cities.

1. Introduction

The objective of this study is to highlight women's role and influence on energy utilization at the household level in an advanced industrial country setting. The study combines behavioral sciences with predictive data analyses in a test case that can be replicated using big data for better energy policy management. When discussing energy, most Energy Engenderment issues are limited to developing country settings and the use of cook-stove technologies and fuel woods, not transcending into the household utilization of energy. Fields related to energy such as oil and gas, nuclear, security, and technology implementation have long been dominated by males even though the trend has recently started to change. In their 2010 report, the U.S. Department of Energy's (DOE) Council on Women and Girls indicated that the "DOE workforce is 37.70% female and 62.30% male" (DOE, 2010, 2). The DOE in recent years has allocated resources and initiatives to support science, technology, engineering and mathematics (STEM) education in both creating opportunities and increasing awareness for female employees and students.

1.1. The engenderment of energy in the industrialized world

The engenderment of energy has previously been addressed almost exclusively as a developing country issue, as the

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relationship between gender and energy in the global South has been considered significantly more direct than that in the global North (Roehr, 2002). Just as in the literature on gender and water (see White et al., 1972; Rogers, 1980; Benedict, 1998; Devasia, 1998; Regmi and Fawcett, 1999; Upadhyay, 2005; Hawkins and Seager, 2010), there is a more obvious physicality to the processes surrounding the use of energy. In a developing world context, many interventions have focused on planting/reserving spaces for fuel wood production and improving cook-stove technology in order to conserve fuel wood (Roehr, 2002; Clancy and Roehr, 2003; Carlsson-Kanyama and Linden, 2007; see Farhar, 1998; Cecelski, 2001, 2004; Clancy et al., 2011). Until recently, "it has even been questioned whether or not there is a Northern perspective on gender and energy" (Carlsson-Kanyama and Linden, 2007, 2163; see also Clancy and Roehr, 2003). The general consensus has been that energy in the Northern context is "gender-neutral; women and men [have been] regarded as equal in their uses of and views about energy, hence policies accurately reflect the needs and wishes of the [entire] population" (Clancy and Roehr, 2003, 16). However, Clancy and Roehr (2003, 20) have recently argued that there is in fact "a distinct gender dimension in the way women's and men's lives are affected by [and affect] energy use" in the developed world (Clancy and Roehr, 2003, 20; see also Roehr, 2002). Unfortunately, most published scholarly works in Energy Engenderment in advanced industrial country settings are outdated and limited to mainly European nations where smaller home sizes, more environmentally friendly viewpoints (Thompson, 2007), and lower energy intensities wash out significant correlation to household energy utilization. The one most recent and relevant exception is a study in urban Jiangsu Province, China. The author concludes from an internet-based survey that "women and older people are the main groups that have more interpersonal interaction about energy conservation…" therefore targeted efforts can be more effective through a female and older audience (Yue et al., 2013, 673).

1.2. Technology meets society: combining behavioral and technical studies

Conservation remains one of the most cost-effective, and environmentally friendly forms of creating additional sources of water and energy for our growing populations. The impact of engaging women in residential energy management and decision-making is yet to be assessed in an industrialized setting and it is why San Antonio was chosen for this study. San Antonio is the seventh largest city in the United States (US) and represents a growing energy economy and a microcosm of tomorrow's America in terms of diversity and infrastructure. At approximately 1,409,019 occupants, it is the second largest city in Texas with almost two-thirds Hispanic/Latino minority population (U.S. Census Bureau, 2010) and a rapid growth driven by emigration from other states, the presence of large military installations, the cloud computing industry, and tourism. San Antonio is also ranked seventh in the nation for job growth particularly with regards to military expansions, the healthcare industry, and a renewed interest in oil and gas exploration along with non-traditional energy resources such as the construction of solar and wind farms (DeVol et al., 2011).

Energy efficiency and conservation are goals central to ensuring our ability to meet future national and global energy needs (Schipper and Meyers, 1992). Improving energy conservation efforts begins with developing a clearer picture of the interrelated technological, cultural, and behavioral factors affecting energy consumption (Mazur-Stommen and Farley, 2013). By clearly defining these factors, we can augment targeted programs, while maintaining cost and standard of living (Dietz et al., 2009). "About one-fifth of total global energy demand originates from the residential sector – from the requirements to heat, cool, and light residential dwellings" (Brounen et al., 2012, 2). In the US, residential buildings account for 39% of total electricity consumption (US Department of Energy 2011; and Kavousian et al., 2013). Electricity consumption in the US residential sector grew by 27% from 1990 to 2008 (Kavousian et al., 2013). Unfortunately, univariate technical interventions continue to dominate current energy efficiency programs in the residential sector, as they are considered easier to implement and measure (Mazur-Stommen and Farley, 2013; and Brounen et al., 2012). As Mazur-Stommen and Farley (2013, 1) note, "All demand-side and energy efficiency programs involve human activity and decision making. Yet, variables and their dynamics in explaining "behavioral aspects of energy use remain unexplained outside of econometrics" (Kowsari and Zerriffi, 2011).

Programs can achieve greater impact and deeper savings by incorporating insights from social and behavioral sciences with technical retrofit strategies. The analysis of gendered differences in energy use behaviors and attitudes remains particularly underanalyzed, especially within Northern industrialized nations (Cecelski, 2001, 2004; Roehr, 2002; Clancy and Roehr, 2003; UN Economic and Social Council, 2006; Clancy et al., 2006; Carlsson-Kanyama and Linden, 2007; Heinzle and Känzig 2010; D'Agostino et al., 2011). Consequently, we argue, that an interdisciplinary perspective (Strauss et al. 2013a, 2013b; see also Wilk and Wilhite, 1983; Erickson, 1986; Lutzenhiser, 1992, 1993; Wilhite et al., 1996; Wilk and Wilhite, 1983 ; Wilk, 2002) will be critical to addressing this issue – and similar important gaps in research – necessary to accelerate the effective union of technology and people (Mazur-Stommen and Farley, 2013; D'Agostino et al., 2011; Lutzenhiser, 1992, 1993).

2. Methods

2.1. Theoretical foundation

The goal of this study theory is to promote building an intrinsic form of energy and water resources conservation through the female head of households' inherent roles as mothers, teachers, mentors, friends, siblings, daughters, and active contributing members of our society. If for no other reason, the outcome will also generate economic savings and the use of more diverse and targeted messaging that includes females and children. Section 2.1 builds the framework of this intrinsic message through investigating (1) Gender Roles and the Division of Labor; (2) Women's Role and their Household Influence; and (3) Thermal Set Point Preferences.

2.1.1. Gender roles and the division of labor

When coupling behavioral and technical sciences, it is assumed that "human use of energy is understood and experienced through cultural frameworks" (Strauss et al. 2013a, 2013b, 10) and influenced by "shared expectations about appropriate qualities or behaviors" which most individuals must abide by in order to operate successfully within a particular society (Eagly, 1987, 13). Gender roles are normative and are typically applied to individuals on the basis of their socially identified gender (Eagly, 1987, 12). Traditionally, the concepts of "sex" and "gender" have been considered inherently related, and often used interchangeably as the biological and phenomenological sides of the same coin (Heinzle and Känzig, 2010). However, as West and Zimmerman (1987) have argued, it is important to realize that sex and gender are analytically independent – one does not necessarily predetermine the other. As Heinzle and Känzig (2010, 13) note, "gender is