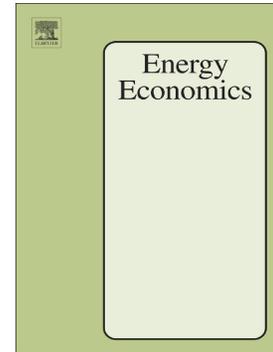


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Households' response to changes in electricity pricing schemes:
Bridging microeconomic and engineering principles

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Households' response to changes in electricity pricing schemes: bridging microeconomic and engineering principles

Walid Matar¹

Abstract

This paper presents a computational take on households' response to price changes. Many studies use assumptions (i.e., price elasticities) that were estimated using historical information; however, if a price change has not been experienced in the past, the response may not be statistically predicted. While other papers have explored price response behavior internally through microeconomic principles, many factors affect a household's electricity use, including the construction of the dwelling, outdoor air temperature, and efficiency of the air conditioner. We have superimposed a physical model, which determines hourly power loads, with a utility maximization component.

The dwelling itself is calibrated to one in Saudi Arabia, but we test households that have various preferences in their utility function, levels of thermal insulation, and income. We further analyze a wide range of electricity pricing schemes; some are progressive tariffs, while one is defined hourly. The extent to which the prices are raised in the alternative schemes has never been experienced in Saudi Arabia. Our analysis shows that households with low electricity preferences exhibit a larger short-run response than would be derived from the aggregate price elasticities estimated statistically. Moreover, improved building insulation affects the household's decision-making process.

Keywords: demand response; electricity use; households; physical factors; electricity price

1. Introduction

Many empirical studies have related electricity demand to various factors, like degree days, income, electricity price, and the prices of other energy goods (e.g., Filippini, 1999; Al-Faris, 2002; Atalla and Hunt, 2016). One output of these analyses is statistically-estimated price elasticities based on historical information. Atalla and Hunt (2016), for example, estimated a negligible value for the short-run price elasticity of electricity demand for households in Saudi Arabia. Analysts often use these price elasticities as input in their mathematical models to measure how households may respond to a price change (e.g., Matar and Anwer, 2017; Ghaith and Epplin, 2017). This, however,

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