Efficiency investments and curtailment actions: complement or substitute

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Abstract

Households' energy-saving behaviors are often categorized into efficiency investments and curtailment actions. Although households utilize these two behaviors simultaneously, previous studies have analyzed these two behaviors separately. In this study, we develop an energy-saving model based on a household production framework to show how these two behaviors are related each other. We assume that a household receives utility from consumption of market goods and energy service. Considering the fact that time is often required for curtailment actions, we further assume that a household faces a time allocation problem between market work and curtailment actions. If a household chooses to work long hours, it earns more income but loses time for curtailment actions. Low-level curtailment actions result in the increase in energy consumption and decreases the consumption of market goods. Instead of spending time for curtailment actions, a household can reduce energy consumption by investing in energy efficiency. Although a household can reduce the effective price of energy service through efficiency investment, a household needs to decrease the consumption of market goods. After characterizing household's energy saving behavior, we show that efficiency investments and curtailment actions can become either complement or substitute. In the empirical section, we

use microlevel data from the Survey on Carbon Dioxide Emission from Households (SCDEH) to examine whether two behaviors become either complement or substitute in a real world setting. SCDDH has a wide variety of information related to household's energy usage, and both curtailment actions of households and vintage of appliances that households own were surveyed. Using this information, we examine whether there is a variation in the intensity of curtailment actions between households owning new and old appliances. Our empirical result reveals that a household owning a newer appliance tends to take curtailment actions more actively. Therefore, we find a complementary relationship, i.e. households investing in energy efficiency take curtailment actions more aggressively.

Keywords: Curtailment actions; Efficiency investments; Household production; Micro-level data