# AN ECONOMIC ANALYSIS OF CONSUMER RESPONSE TO NATURAL GAS PRICES

FREDERICK JOUTZ AND ROBERT P. TROST

PREPARED FOR THE AMERICAN GAS ASSOCIATION
MARCH, 2007



AGA
American Gas Association

# An Economic Analysis of

# Consumer Response to Natural Gas Prices

**Frederick Joutz and Robert P. Trost**[1]

Prepared for the American Gas Association
March, 2007

Published by
The American Gas Association
400 North Capitol Street, NW, Suite 450
Washington, DC 20001
www.aga.org



[1] Professors of Economics, George Washington University. Contact information: fred.joutz@gmail.com and trost@gwu.edu. We are grateful for the support from the AGA, especially the helpful comments from Bruce McDowell, David Shin, and Paul Wilkinson. We are responsible for any remaining errors.

# Table of Contents

## Executive Summary

Introduction and Key Findings

The consumption of natural gas per household has been declining, on a weather-normalized basis, since about 1980. Over time, natural gas consumers have been tightening their homes, purchasing more efficient appliances and turning down their thermostats. Given the significant increase in natural gas prices since 2000, the American Gas Association (AGA) decided to examine whether or not the trend in declining use has changed in this higher-priced environment. The results of this study are based on monthly data submitted by 46 local natural gas distribution companies that serve nearly 30 percent of all residential natural gas customers throughout the U.S. Some companies submitted data as far back as the early 1980's. The key findings of the study are as follows.

- A trend in declining use per residential natural gas customer of 1 percent annually has been documented[2] back to 1980. This decline rate has accelerated since the year 2000.
  - Weather-adjusted use per residential customer fell by 13.1 percent from 2000 through 2006.
  - The annual rate of decline in this 2000 to 2006 timeframe more than doubled relative to the pre-2000 period, increasing to 2.2 percent annually.
  - Further acceleration was witnessed in the 2004 to 2006 period, as evidenced by a 4.9 percent annual rate of decline.
  - The decline in use per customer has accelerated since 2000 in all 9 geographic regions analyzed.
- No appreciable changes in the price elasticity of demand were observed post-2000. Price elasticity of demand refers to the percentage change in demand for a good relative to a percentage change in price. Although the elasticity has not changed over time, it should be noted that natural gas is an essential product that provides heat, hot water and cooking. Despite the essential nature of natural gas, consumers have continued to reduce their consumption at a relatively constant rate with respect to changing prices. Therefore, the large price increases post-2000 have resulted in the large consumption declines noted above.

[2] 2004 AGA Energy Analysis: Patterns in Residential Natural Gas Consumption, 1980-2001.

- This study found a short-run price elasticity of –0.09 and a long-run price elasticity of -0.18. (Long-run elasticity refers to a period of time long enough for consumers to change the capital stock of their energy consuming equipment and the shell efficiency of their homes.)

- These price elasticity estimates are relatively consistent with previous works on this subject.

- The econometric analysis presented in this study predicts a decline of 13.9 percent between 2000 and 2006; the actual decline was 13.1 percent. The decline is attributable to a price effect and the longer-run trend towards tighter homes and more efficient appliances. The price elasticity effect is 7.9 percent - equal to the elasticity estimate of -0.18 times the 44 percent real price increase. The remaining 6.0 percent is explained by the longer-run trend towards tighter homes and more efficient appliances.

- As a general rule of thumb, at the national level we would expect a 10 percent increase in the price of natural gas to result in nearly a 1 percent decline in the average residential use per customer 12 months later – 1 percent attributable to more conservation with existing appliances, 1 percent attributable to the price-induced purchase of more efficient appliances, and 1 percent attributable to the natural turnover of equipment that occurs annually.

Background

Residential natural gas consumption is strongly influenced by three factors: seasonal heating needs; response to price change; and the efficiency changes in appliances and home shells caused by a natural turnover rate to more efficient homes and gas appliances. On a weather-adjusted basis, the price and the long run conservation effects are key determinants of changes in residential natural gas consumption. The price effects can be further decomposed into short-term and long-term effects. Short term effects are decisions made by consumers with the current capital stock. Residential customers "turning down the thermostat" would be considered a short term effect. Long term effects are distinguished from short term effects by the inclusion of the decision to purchase more efficient energy consuming appliances and prematurely retiring less efficient ones. The price elasticity in the long-run is the sum of (1) the short-run demand and (2) the additional changes that occur to quantity demanded one year later because of natural gas price effects on the efficiency of the appliance capital stock and on the shell efficiency of homes[3]. While the separate efficiency and conservation effects due to

[3] It should be noted that if natural gas prices decrease, consumers will not replace recently purchased efficient equipment with less efficient equipment. So there maybe asymmetry with respect to the impact of natural gas prices on appliance and shell efficiency. The efficiency gains in appliance equipment that have occurred in the last several years will not disappear if natural gas prices go down. However, declining prices may lead consumers turning up thermostats to increase comfort levels (in the short-run). In the very long-run, a decline in prices could lead to an increase in burner tips per customer.