

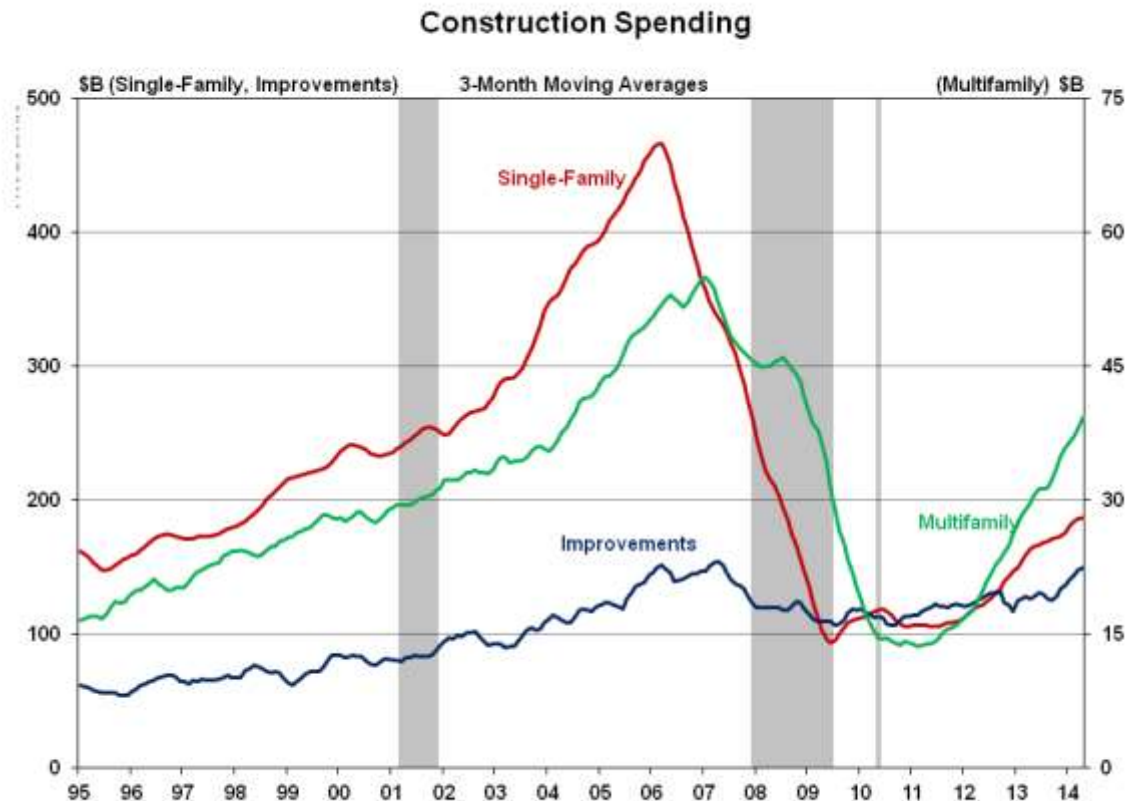


The Importance of Natural Gas in Multifamily Energy Efficiency: Project Overview

Charlie Haack
Manager
ICF International
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Introduction

- AGF commissioned this study to help expand the benefits of gas service to multifamily buildings
- Multifamily construction is **UP** over the past 5 years

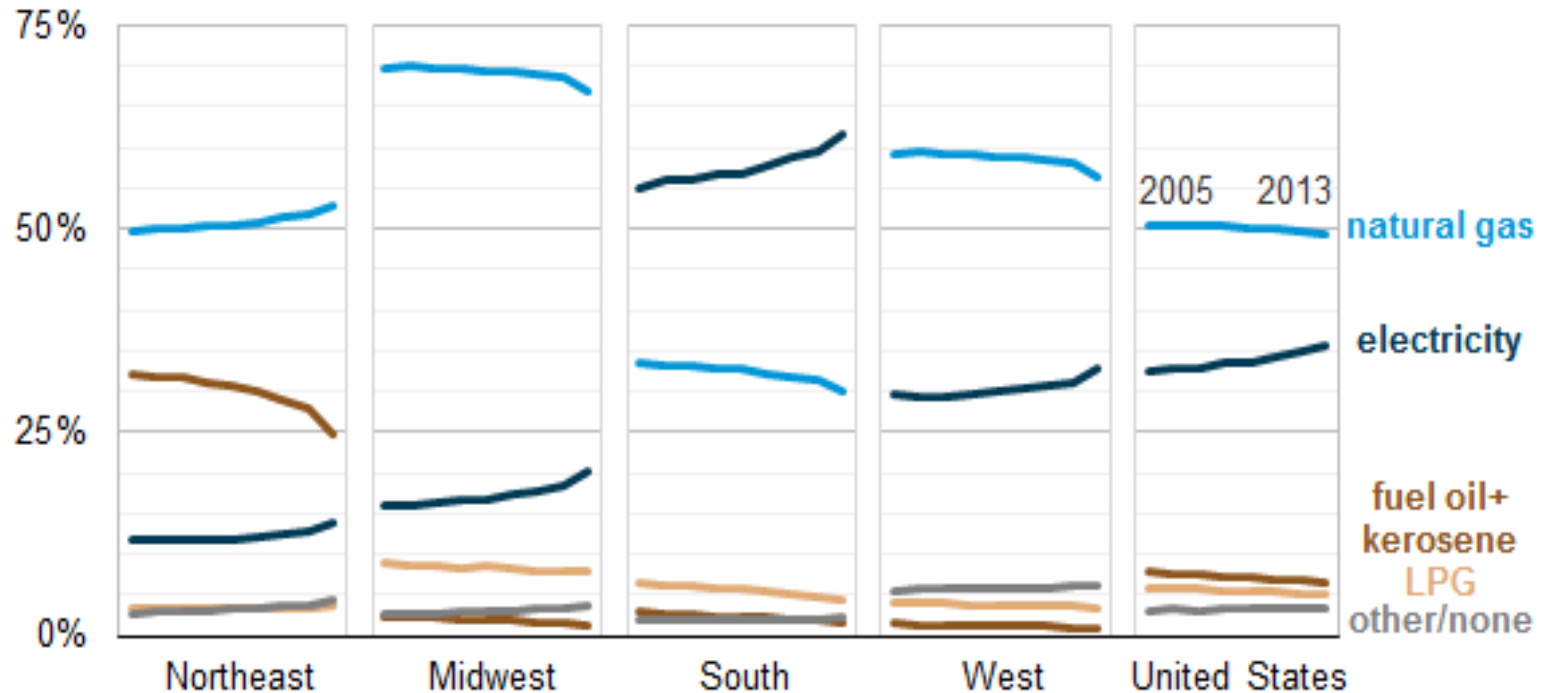


Introduction

- During the same time gas market share has declined

Primary heating fuel choice (2005-13)

percent of households within Census division or nation



Organization of the report

Three main areas of focus:

- **Barriers:** technical, economic, physical, market, regulatory
- **Benefits:** energy, environmental, economic, other benefits at the technology, building, and national levels
- **Solutions:** policy, program, and other solutions that gas utilities and their allies can use

Barriers

Technology Barriers: efficiency comparisons

Water Heating	Gas		Electric			
	NAECA Min.	ENERGY STAR	NAECA Min.	Heat Pump Water Heater		
Energy Factor	0.62	0.67	0.92	2.00*	0.95*	[Increased Space Heating]**
Annual input (Therms for gas; kWh for electric)	151	136	2,685	686	748	328
Site MMBTU	15.1	13.6	9.2	6.0		
Source MMBTU	16.6	15.0	28.9	19.0		
Annual Water Heating Required (output in Btu)	9,385,422	9,385,422	9,385,422	9,385,422		
Total Annual Water Heating Cost (\$)	\$191	\$171	\$342	\$224		

Barriers

Technology Barriers: efficiency comparisons

Space Heating	Gas			Electric	
	NAECA Min.	ENERGY STAR South	ENERGY STAR North	NAECA Min.	ENERGY STAR ASHP
AFUE/HSPF	80%	90%	95%	7.7	8.5
Annual input (therms for gas; kWh for electric)	132	117	111	1,583	1,399
Site MMBTU	13.2	11.7	11.1	5.4	4.8
Source MMBTU	14.5	12.9	12.24	17.1	15.1
Annual Fuel Cost	\$166	\$147	\$140	\$202	\$178

Barriers

Physical constraints on gas equipment

- Supply piping chases
- Air intake/ventilation ducting
- Limited space in mechanical closets
- Sizing/efficiencies gas equipment in low heating load climates



Barriers

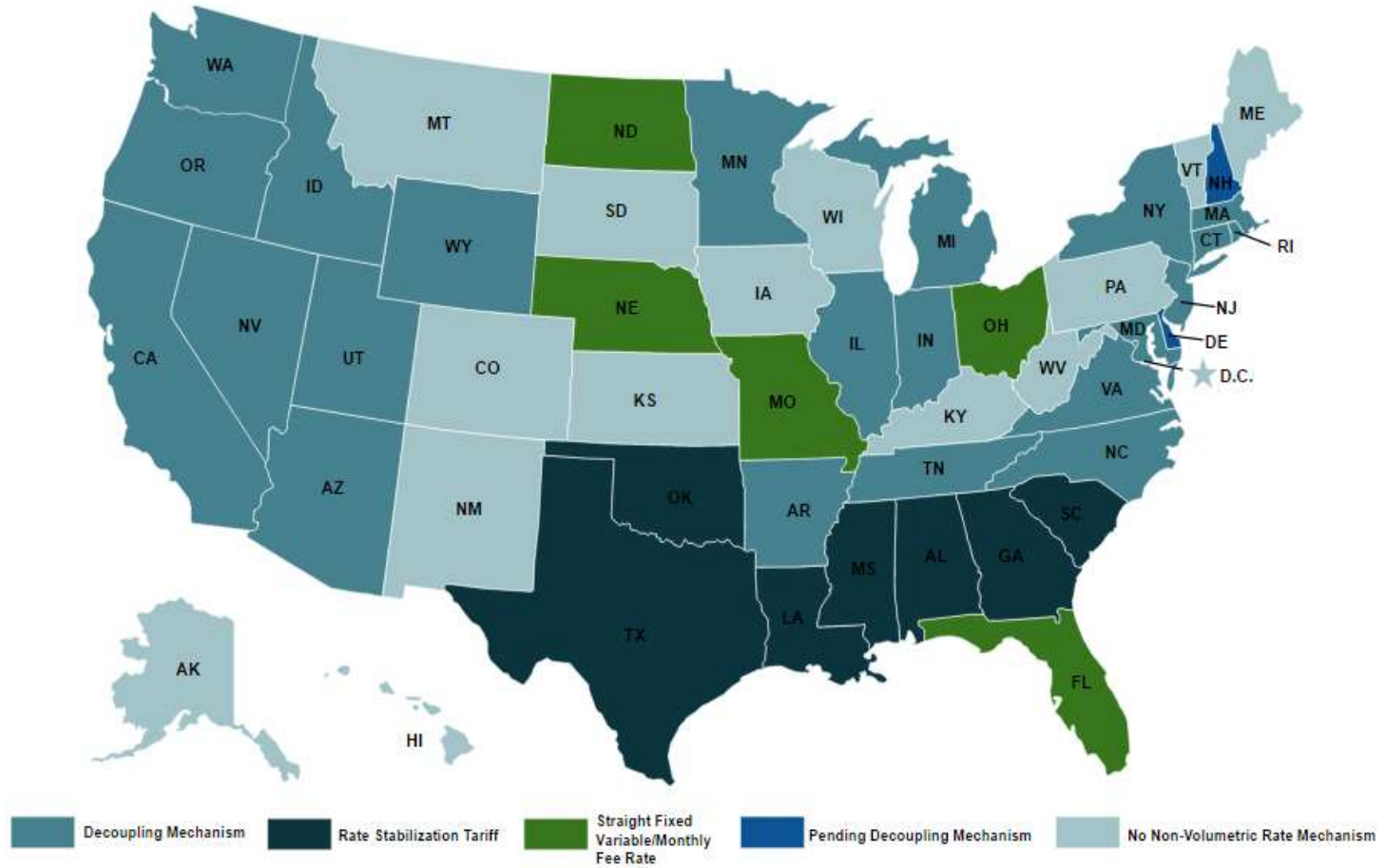


Policy Barriers



Barriers

Ratemaking policies



Source: American Gas Association

Barriers

Economic and market barriers

- **First costs** of gas service, and gas end-use equipment—all-electric designs seen as lowest-cost solutions
- **Split-incentive**, owner-tenant barrier—owners care about first costs, tenants care about operating costs
- **Information barriers**—tenants, owners, managers, contractors, designers not informed on gas benefits, technologies, practices

Benefits

- Source energy and operating cost savings—per unit

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Benefits

- Nationwide benefits for MF space heat/hot water conversion could total \$2.2 billion in lower energy bills, and 182 Trillion Btu in source energy savings.



Benefits

- Reduced air pollutant emissions: up to 20 MMT CO2 nationally

Water Heating	Gas		Electric	
	NAECA Min.	ENERGY STAR	NAECA Min.	Heat Pump Water Heater
Energy Factor	0.62	0.67	0.92	2.0 0.95
tons CO ₂ Emissions	0.8030	0.7220	1.5007	0.9848
tons SO ₂ Emissions	0.0000040	0.0000036	0.0032	0.0021
tons No _x Emissions	0.0006	0.0006	0.0014	0.0009

Assumptions:

- Electricity emission factors from US10 Data, eGRID 9th edition Version 1.0
- Natural gas emissions data from:
 - NOx SO2 <http://www3.epa.gov/ttnchie1/ap42/ch01/final/c01s04.pdf>
 - CO2 http://www.epa.gov/sites/production/files/2015-12/documents/emission-factors_nov_2015.pdf

Benefits

- Reduced air pollutant emissions: up to 20 MMT CO₂ nationally

Space Heating	Gas			Electric		
	NAECA Min.	ENERGY STAR	ENERGY STAR	Electric Res.	NAECA Min.	ENERGY STAR
AFUE/HSPF	80%	90%	95%	98%	7.7	8.5
tons CO ₂ Emissions	0.6980	0.6204	0.5803	1.9127	0.8851	0.7820
tons SO ₂ Emissions	0.0000035	0.0000031	0.0000029	0.0041	0.0019	0.0017
tons No _x Emissions	0.0005	0.0005	0.0005	0.0017	0.0008	0.0007

Assumptions:

- Electricity emission factors from US10 Data, eGRID 9th edition Version 1.0
- Natural gas emissions data from:
 - o NO_x SO₂ <http://www3.epa.gov/ttnchie1/ap42/ch01/final/c01s04.pdf>
 - o CO₂ http://www.epa.gov/sites/production/files/2015-12/documents/emission-factors_nov_2015.pdf

Benefits: Building Case Study

- Energy Solutions Center-commissioned study shows gas systems use less source energy and cost less to operate

Space Heating / Water Heating	Baseline System: Air-source heat pump	System 1: Central Boiler & Chiller	System 2: Combination Boiler & Packaged DX	System 3: Packaged NG Furnace with DX Cooling
AFUE / Energy Factor	3.2 COP	90 / 0.9*	80 / 0.82	85 / 0.8*
Annual input (therms)	3,084 kWh	202	216	192
Site MMBTU	10.5	20.2	21.6	19.2
Source MMBTU	33.2	22.3	23.7	21.1
Annual Fuel Cost per unit/apartment	\$301	\$189	\$201	\$179

Solutions

Gas technologies

- Tankless water heaters
- Condensing furnaces
- Combination space heat/hot water systems
- Small capacity heating systems
- Renewable natural gas (RNG)



Solutions

- Utility initiatives
 - Marketing programs
 - EE programs

- Public policy initiatives
 - State PUC proceedings
 - Fed/state/local environmental regulations

- Technical society/NGO initiatives
 - ZNE—DOE definition uses source energy calculation
 - ASHRAE
 - ICC energy codes

Solutions

AGA Member Case Studies

- Atlanta Gas Light
- Atmos Energy
- CenterPoint Energy
- Con Edison
- New Jersey Natural Gas
- PSEG
- Washington Gas Light





Contact information

Charlie Haack | Manager, Energy Efficiency Analytics & Policy

ICF International

Charlie.Haack@icfi.com

Rick Murphy | Managing Director, Sustainable Growth

[American Gas Association](#)

400 N. Capitol St., NW | Washington, DC | 20001

P: 202-824-7301 | F: 202-824-9089 | rmurphy@aga.org

Discussion

