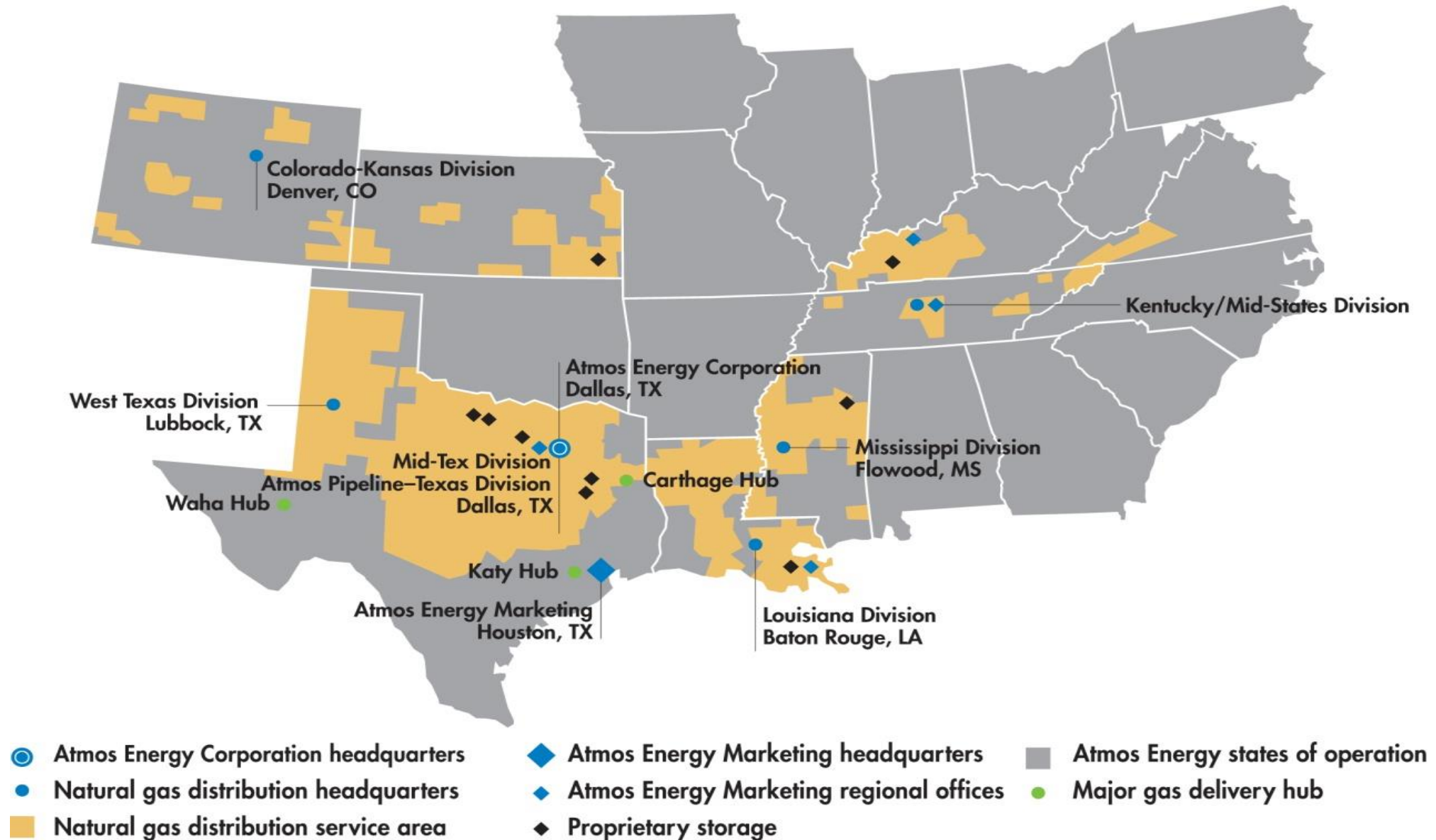
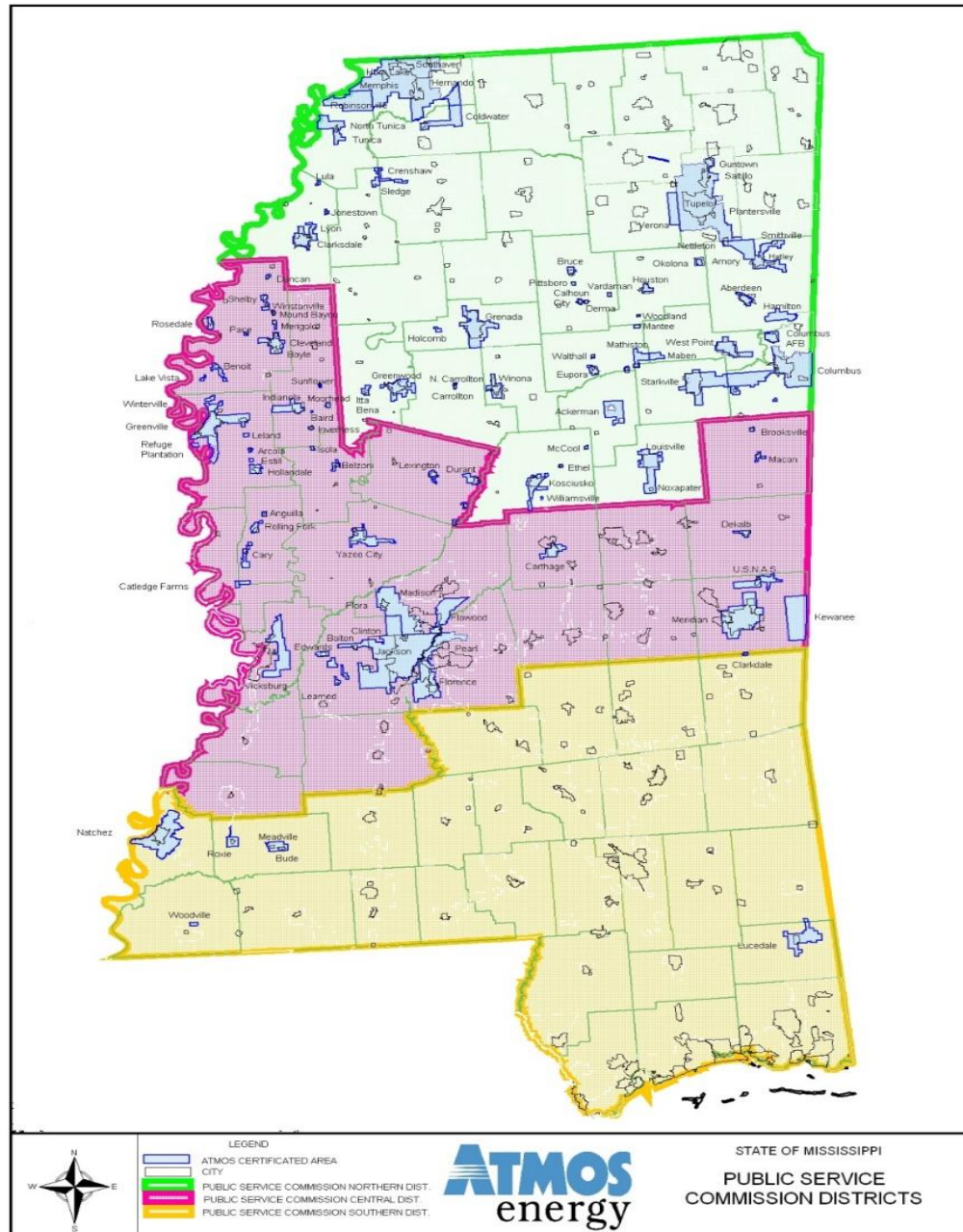


Gas Expansion in Mississippi The Rural Challenge

**NARUC Gas Subcommittee
February 14, 2016**



Mississippi Division



Atmos Energy - Mississippi

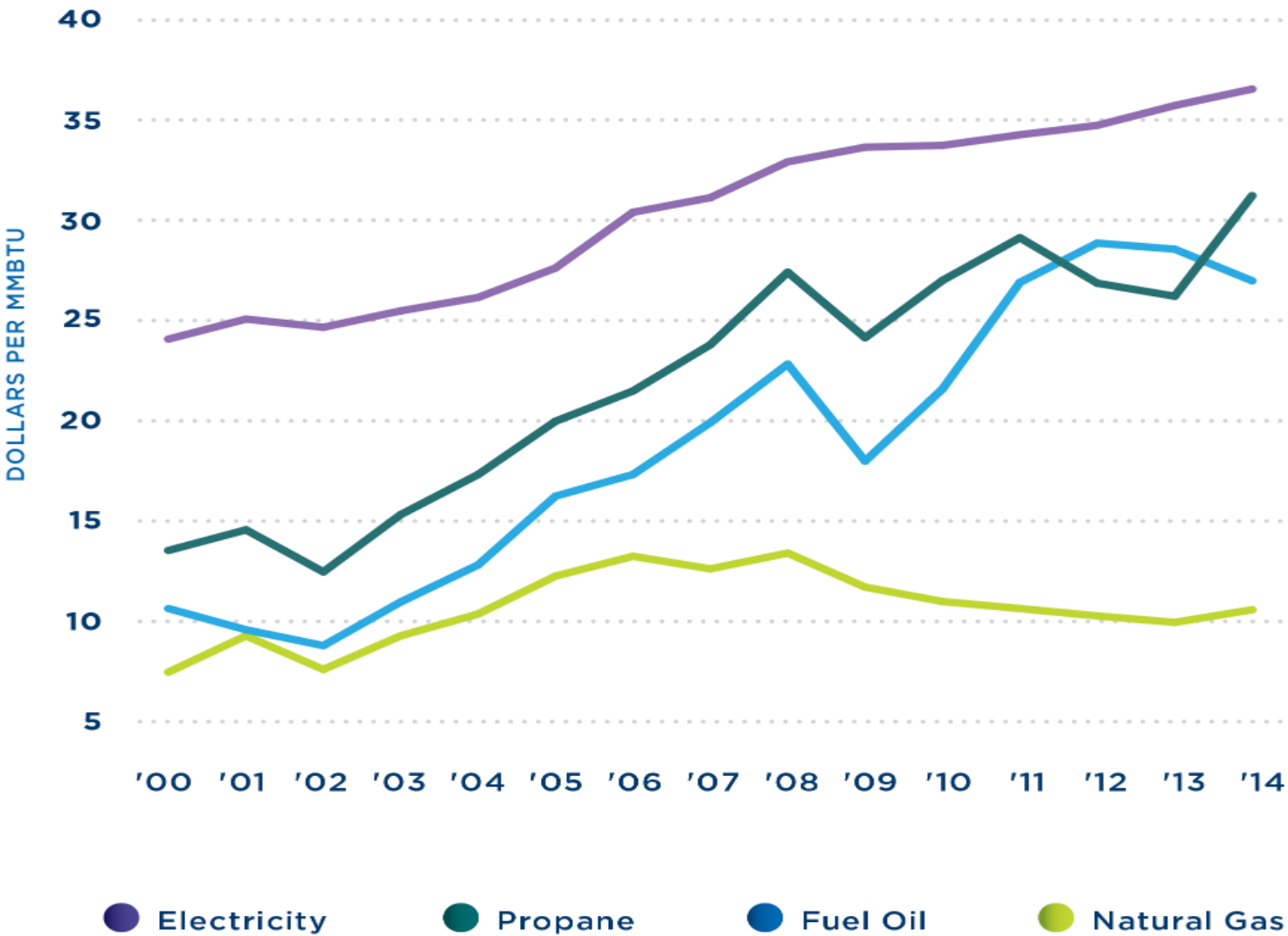
- HQ Jackson area
- 350 employees
- 260,000 customers
- 44 counties
- 113 communities
- 1/3 urban/suburban
- 2/3 rural/small towns

Mississippi State-Wide

- Only 35% households served with natural gas



Annual Energy Prices to Residential Consumers

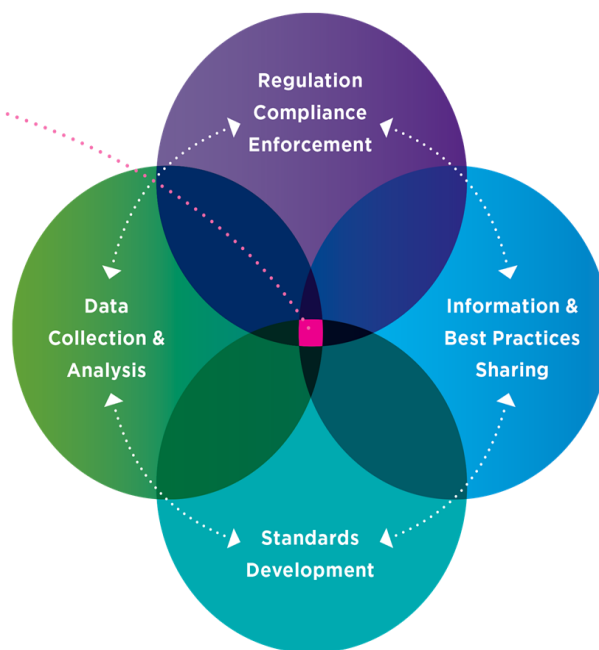


The Value Proposition of Natural Gas

Savings for Consumers

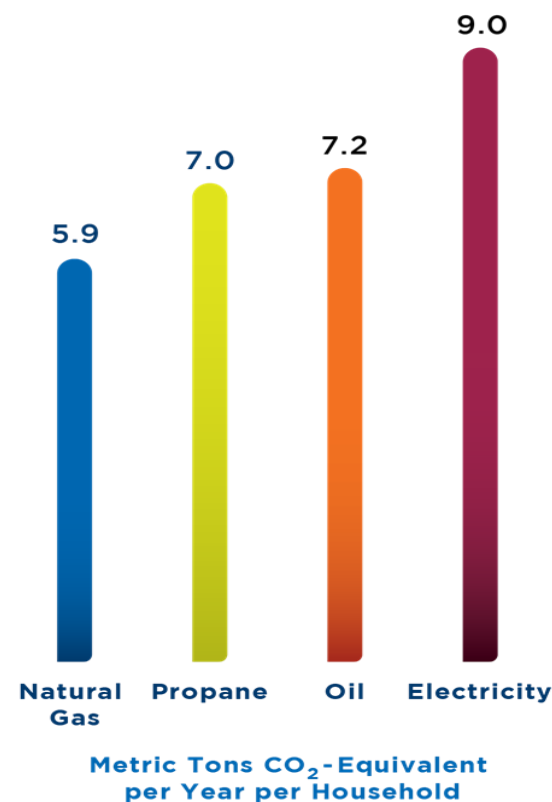


Safest Energy Delivery System in America



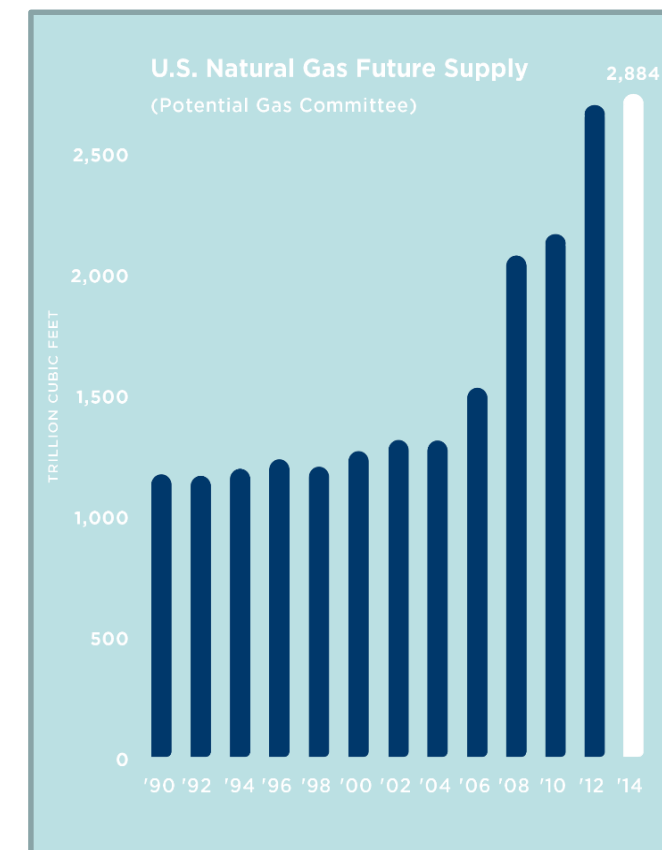
Clean & Efficient

Using natural gas in homes reduces greenhouse gas emissions



Abundant Supply

Enough natural gas to meet America's diverse energy needs for more than 100 years.



Small Business Help Center



Small Business Incentives

- Gas & Electric tariffs
- Discounted rates
 - Qualifying new or expanding small businesses
 - Discounts range from 15-25%
 - 1-2 years
- Waiver of deposits
 - Some offer extended terms
- Since 2011

Supplemental Growth Rider



- Pilot Program – 5 years
 - \$5M annual funding
 - >\$5M w/PSC approval
 - 12% ROE
 - Customer surcharge
 - Project revenues offset future SGR revenue requirements
-
- SGR extends gas facilities to new industrial prospects that were historically uneconomical to serve
 - Economic investment not funded through SGR
 - SGR provides funding to land new plants, expand industrial parks
 - Supports economic development and new job creation
 - Valuable tool in Mississippi's economic development tool box

Supplemental Growth Rider Provides “Leverage”



Industries

- Yokohama Tire
- Green Tech Automotive
- Delta Energy
- Choctaw Manufacturing
- ICE Industries
- Winston Plywood
- Continental Tire

Industrial Parks

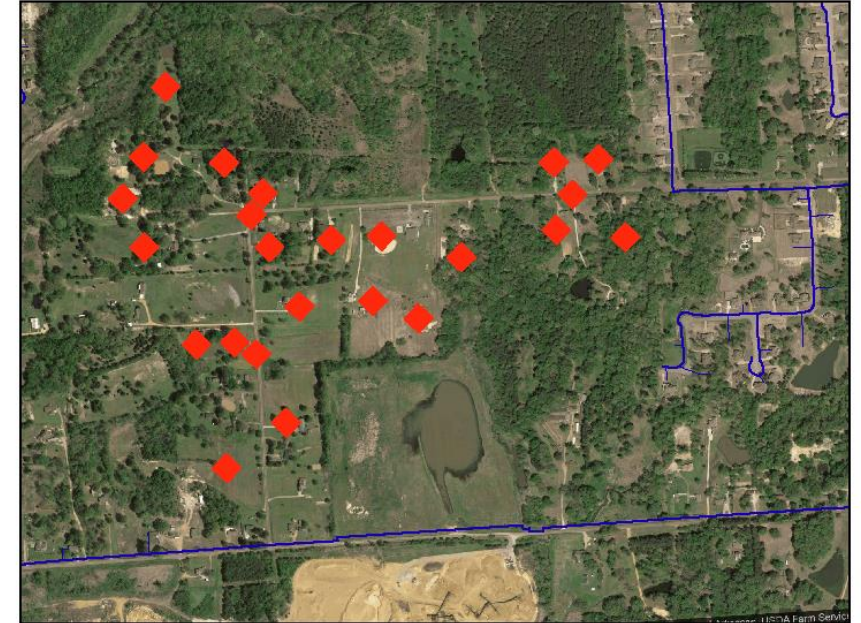
- Kosciusko-Attala County Industrial Park
- Meridian-Lauderdale County Industrial Parks (3)
- Golden Triangle Industrial Park (East)

**5500
New Jobs**

**\$3B Total
Investment**

ZAP The GAP

- Platform created by MPSC
 - Database of “prospective” natural gas customers
- MPSC registers prospects through an online form which is loaded into a data base
- Monthly downloads from the ZTG data base are shared with gas utilities
- Utilities plot the location of registrants via GIS systems to review the commonality with certificated areas and ascertain concentrations of demand
- Areas are then assessed for possible extension of facilities under main extension tariff policies



Recent Tariff Changes - Mississippi

- **Updated Construction Allowances (Residential & Commercial)**
Purpose: better reflect current costs
- **Rural Gas Pilot Program - Three Years**
Purpose: encourage gas expansion into rural areas

Waive AIC if a project does not meet short term economic feasibility parameters, but exhibits long term growth potential

< \$25k	Company's sole discretion
\$25k - \$100k	Submit economic feasibility to MPUS
> \$100k	MPSC approval required

June 1 annual report required on the pilot program

Economic Development & Jobs Creation Task Force

- Purpose is to solicit input from various stakeholders on ideas on how regulatory utility policy can be enhanced to encourage economic development and the creation of greater employment opportunities
- Stakeholders
 - MPSC and MPUS
 - Major utilities
 - Mississippi Development Authority
 - Legislature
 - Governor's office
 - Lt Governor's office
 - Others



Natural Gas Expansion UGI's Pilot - GET Gas

Michael Fessler, Director of Regulatory Affairs

[illegible]

Natural Gas Conversion Statistics

- Since 2008 UGI converted:
 - 62,000 households
 - 55+ large commercial & Industrial facilities
 - ~ \$70 million annually to extend service to new customers (\$76 million in '16)
- In 2015, the 62,000 households that converted to natural gas saved approximately \$50 Million compared to their prior fuel

PA Natural Gas Benefits

- UGI residential customer annual savings due to lower gas costs (Marcellus Shale Impact):
 - **\$700** a customer per year
 - **\$350 Million saved in 2014 compared to 2008**
- Over 90% of the natural gas UGI delivers through our system is produced in the Marcellus Shale Region

What is “GET” and How Did We GET Here Today?

- High Potential for New Gas Conversion Customers
 - Market conditions fueling demand
- April 2012 - First Brainstorming Session
 - Goal: Develop an innovative and creative way to expand natural gas service outside of current tariff extension guidelines
- Result - GET Gas
 - GET “Growth Extension Tariff” - New concept/proposal
 - Focused on facilitating natural gas service expansion into un-served and under-served areas
 - Expand the benefits of natural gas service to new areas within Pennsylvania

What is “GET Gas” ?

- Enhances Current Tariff Line Extension Provisions
 - Benefit of anticipated future customer additions provided
 - Benefit of a 10 year payment schedule which is premise based
- UGI proposal includes a 5 year GET Gas pilot funded at \$15 Million per Pilot Year - Total \$75 Million
 - ½ allocated to Unserved & ½ allocated to Underserved
- Class based surcharge
 - Pass/Fail test based on consistent guidelines

Get Gas Project Guidelines

- 50% Market Share
- Estimated Cost per Customer < \$10,000
- Estimated Main Cost > \$15,000

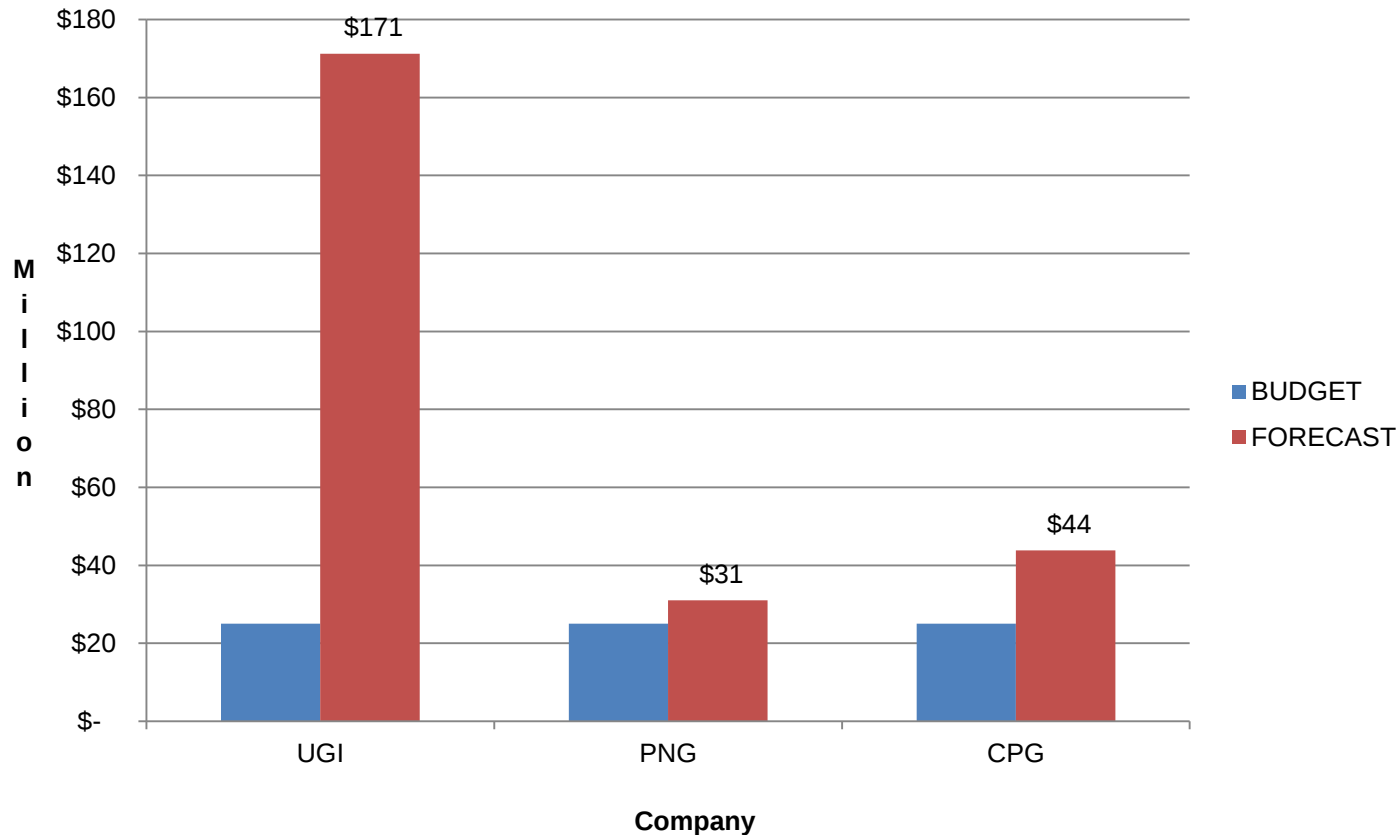
Note: UGI has Ability to Suspend Program if Gas Oil Spread Decreases to an Unsustainable Level

GET Gas Pilot - Settlement Rates

Summary of GET Gas Charges by Company

	UGI	PNG	CPG
Residential Monthly GET Gas Customer Charge (Rates R,RT)	\$ 54.95	\$ 44.90	\$ 21.75
Commercial Monthly GET Gas Customer Charge (Rates N,NT)	\$ 7.86	\$ 23.01	\$ 13.08
Commercial Volumetric Charge (Rates N,NT)	\$ 7.37	\$ 2.71	\$ 1.07

Forecasted Underserved and Unserved Lead Saturation Demand



- GET Leads 4200
- Potential Exceeding \$200 Million vs. Pilot of \$75 Million

Challenges

- Lead Tracking System (MLTS) Interface
- Micro-Site
 - Informational, lead entry, economics, etc.
- Community Outreach & Marketing Materials
 - Municipality Support?
 - Restoration/Permit Fees
- Preliminary Project Analysis & Process
 - Unserved/Underserved
- Internal Resources - Engineering, Sales, Field
- Billing System Enhancements
- Shrinking Oil-Gas Spread

Current Strategic Initiatives

- GET Scorecard
 - Enforce accountability internally
 - Published bi-weekly, includes key milestones
- Special Publicity/Ribbon-Cutting Events
- HVAC Partnering
 - Co-marketing to a set group of projects to offer increased rebates/incentives
- Survey/Focus Groups
 - Survey of GET and non-GET customers in completed projects to date
 - Understand the most effective marketing tactics
- Grassroots Marketing/Sweepstakes

GET Gas Website


Energy to do more®

Making natural gas more available and affordable

Natural gas is one of the cleanest, most abundant and least expensive energy sources in Pennsylvania. Now UGI is helping to give more consumers greater access to natural gas and make the conversion process more affordable with the new GET Gas pilot program.

The UGI Growth Extension Tariff (GET) is an innovative pilot program designed to provide natural gas service to regions without access today. The pilot program is available to homeowners and businesses within the UGI Utilities gas divisions (UGI Utilities Gas Division, UGI Penn Natural Gas and UGI Central Penn Gas).

Get more information about GET Gas today.

Download our FAQ sheet, call us at 1-800-276-2722, or e-mail us at getgas@ugi.com.



Join the Conversation:

UGI Utilities, Inc. is a natural gas and electric utility headquartered in Reading, Pennsylvania. The company is a wholly-owned subsidiary of UGI Corporation, based in Valley Forge. Copyright © 2014 UGI Utilities, Inc. All rights reserved. [Privacy Policy](#).

GET Gas Outreach Materials: Doorhanger

- Canvass neighborhood
- QR code goes to website
- Personalized with Conversion Rep information



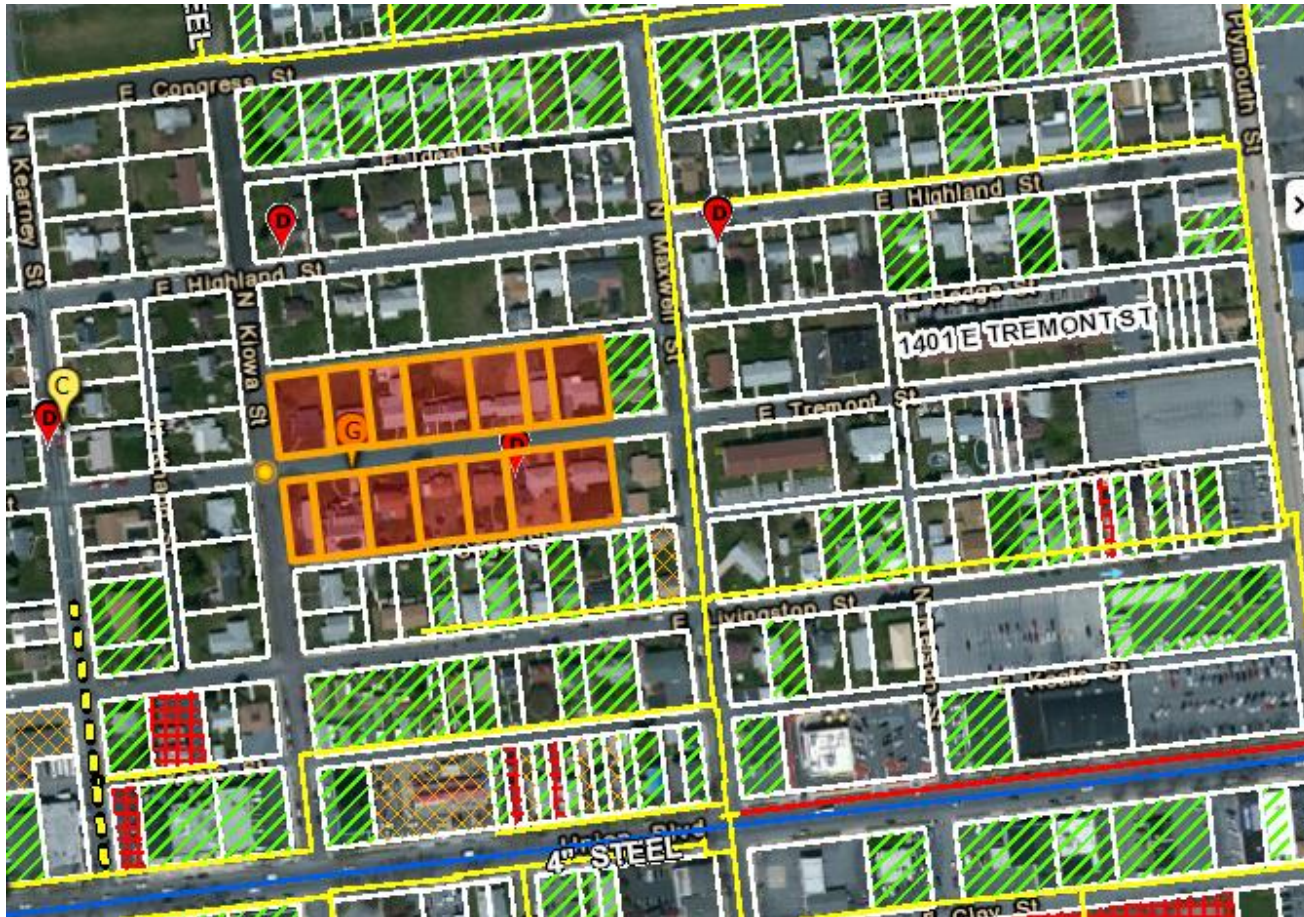
GET Gas Program Demand - Riverside

- GET Gas Unserved Community Example: *Riverside Community*
 - Proactive Community Leadership
 - Outreach to potential customers
 - Permit Fees to be waived - Declaration Signed
 - Low cost installations
 - Currently Under Construction
- Prequalifies for GET Gas
 - 636 Parcels
 - Estimated GET Market Share = 356
 - Estimated Cost per Customer maximum = \$7,433
 - Current Leads = 162 or 25% of the community has already reached out to UGI

Get Gas Program Demand - Riverside

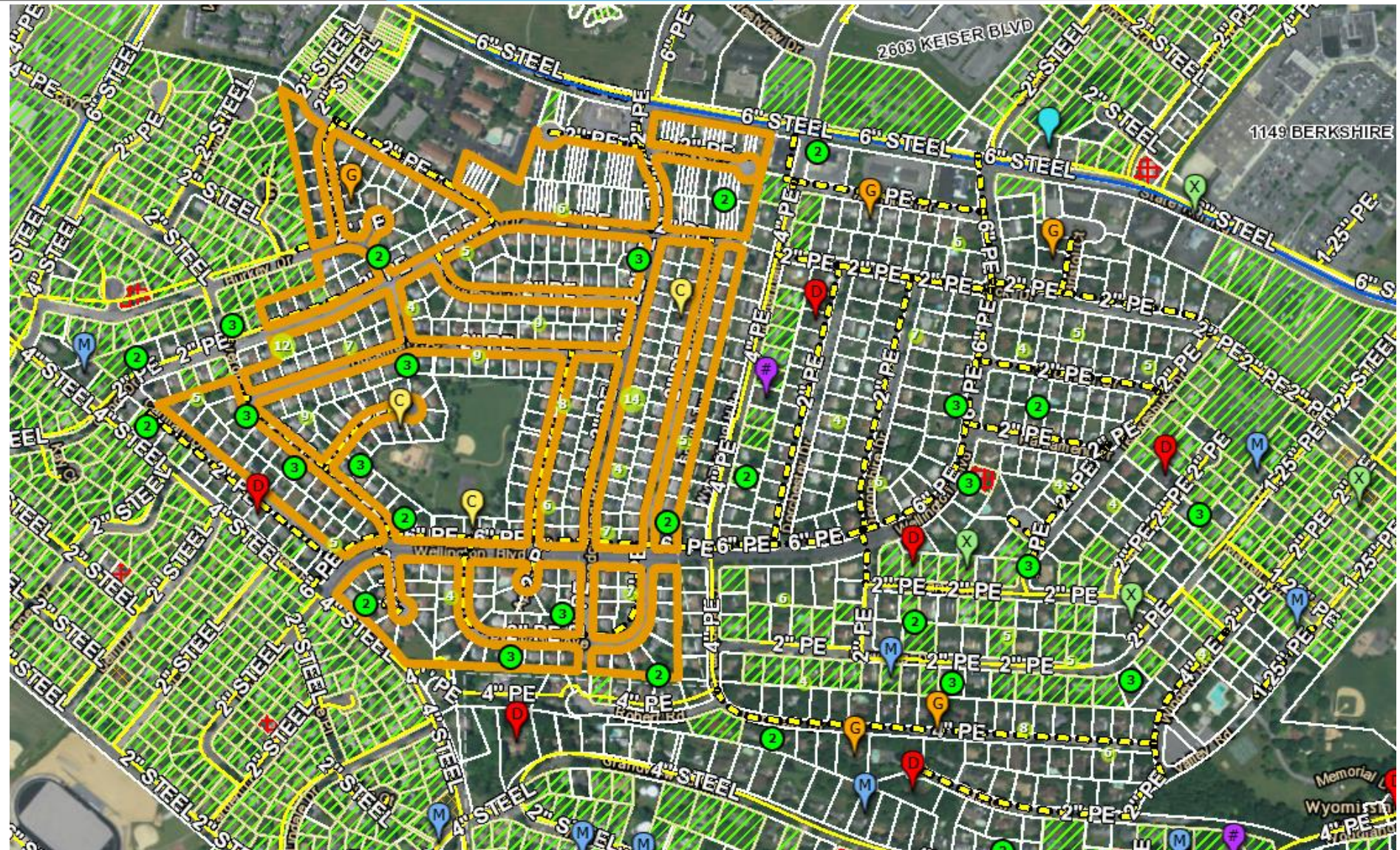


Tremont Street - Allentown



Very Restrictive Mill and Overlay Requirements -
Estimated \$30,000 Additional Cost does not qualify!

Wyomissing Hills - Wyomissing



New Paving Requirements Forced Project to be Split-PHI Under Construction
90 + Leads in Area - ~ 400 Parcels

Wynnewood Dr - Lancaster



Not to Scale

Project Location	Total Parcels	Projected Customers	Projected Year 1 Customers	Actual Year 1 Customers	Estimated Cost per Customer
Wynnewood	40	20	5	9	\$7,500

Montieth - Reading



Project Location	Total Parcels	Projected Customers	Projected Year 1 Customers	Actual Year 1 Customers	Estimated Cost per Customer
Montieth	26	17	4	8	\$5,317

UGI - Natural Gas Demand Questions

Expanding Gas Service: Regulatory and Economic Considerations

Ken Costello, Principal Researcher
National Regulatory Research Institute

before
NARUC Subcommittee on Gas

February 14, 2016

The Demand for Extending Gas Service

- Low natural gas prices relative to other energy prices
- Other consumer benefits from switching to natural gas
- For many energy consumers, a quick payback (e.g., 2-3 years) from converting to natural gas
- Potential public benefits in bolstering economic development and a cleaner environment
- Demand centered in New England, New York, outer suburban and rural areas in other regions of the country
- Demand in both unserved and underserved areas

Regulatory Issues

- Rolled-in vs. incremental pricing
- Effect on existing customers
- Economics of fuel switching
- Economic test for line extensions
- Utility incentives for extending lines
- Utility promotional and marketing practices
- New-customer contributions
- Cost recovery for a utility
- Building-out ahead of customer commitment
- Subsidization of new customers
- Role of local, regional and state governments

Traditional Approach

- Assumption of no public benefits
- Conservative economic tests:
 - ✓ They tend to understate the full benefits of gas line extensions on a utility and existing customers
 - ✓ They, therefore, overstate the upfront required payments from new customers
- Rationale and outcomes
 - ✓ The “no burden” standard is upheld
 - ✓ New customers pay “excess” costs
 - ✓ Utilities play a passive role
 - ✓ Utilities arguably are underinvesting in new line extensions

Possible Obstacles

- **Market-based**

- Inertia
- Information deficiency
- Uncertainty of the benefits
- High initial costs
- High transaction costs
- Capital constraints

- **Utility-driven**

- Economic tests
understating the benefits
- High upfront CIAC
- No explicit strategy to
bolster fuel switching
- Minimalist role (e.g.,
passive utility)

Model Line-Extension Policy

- **Balancing the interests of stakeholders**
 - ❖ Financial viability of the utility
 - ❖ Affordability of economical fuel switching to new customers
 - ❖ Minimal negative effect on existing customers
 - ❖ No unfair competitive advantage to any energy source
 - ❖ Overall, balancing of regulatory goals related to fairness, economic efficiency and other designated outcomes

Model Line-Extension Policy – *continued*

- **Regulatory objectives**
 - ✓ Good energy-consumer incentive to fuel switch
 - ✓ Robust utility incentive
 - ✓ Affordable economical line extensions to prospective customers
 - ✓ Fairness to all stakeholders, including other energy suppliers
 - ✓ Compatibility with other governmental objectives (e.g., economic development, clean air)

Model Line-Extension Policy – *continued*

- **Dealing with conflicting objectives**
 - Commissions strive to make the best decision under uncertainty and conflicting objectives
 - One example is maximizing fuel switching while also (1) minimizing harm to existing customers and (2) creating a level playing field for all energy sources
 - Another example is giving prospective new customers proper price signals while encouraging all economically justifiable fuel switching

Gas Line Extension Actions Aligned with Regulatory Objectives

Regulatory Objective	Action
Good utility incentive for pipe expansion	▪ Opportunity for utility profits ▪ Utility fully recovering prudent costs ▪ Regulatory scrutiny of costs ▪ Moderate regulatory lag
Good energy-consumer incentive for fuel switching	▪ Proper price signals ▪ Adequate information ▪ Minimal transaction cost ▪ Reasonable upfront cost
Affordable economical line extensions to prospective customers	▪ Spreading out over time new customer share of line extension costs
Fair to all stakeholders	▪ Utility fully recovering prudent costs ▪ Protection of existing customers from cost shifting ▪ Level playing field for all energy sources ▪ Avoidance of excessive costs to new customers
Compatibility with other public policy objectives (e.g., economic development, cleaner air)	▪ Subsidies to new customers with evidence of public benefits ▪ Combined public and ratepayer funding with demonstration of public benefits

Pricing and Surcharges to New Customers

- What are the proper principles for pricing utility service for new customers?
- Should a utility, for example, use rolled-in pricing or incremental pricing for setting prices to new customers?
- Should a utility charge new customers an additional amount that falls outside the tariff?
- If so, how should the utility determine the size and method of new-customer contribution?

A Special Case: Unserved Areas

- ❖ Constructing new lines may be unprofitable to the utility or unaffordable to new customers
- ❖ Difficulty in accurately predicting the number of customer conversions
- ❖ From a lifecycle perspective, new customers should be willing to pay the utility through rates and special surcharges to make the utility financially whole
- ❖ But, given the expected revenues for the utility and line costs, the required advanced contribution per customer might come to, say, \$10,000
 - Just like other investments that payoff in the end, consumers may forgo them because of the high initial cost
 - Many households, for example, may decide it cannot afford to withdraw \$10,000 from their savings at this time, or take out a loan of that amount

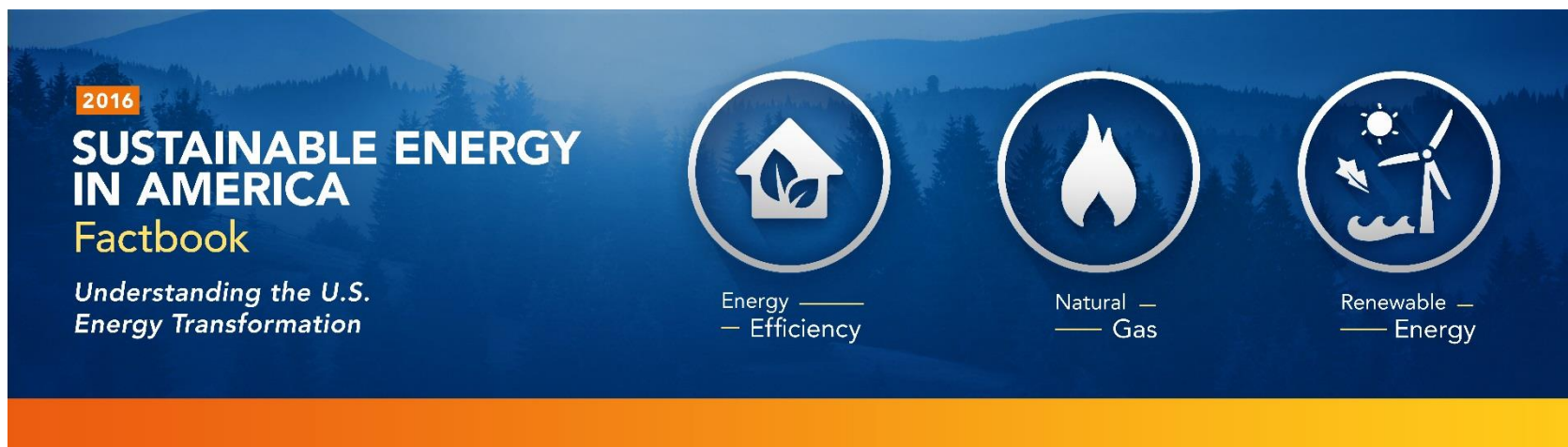
A Special Case – *continued*

- ❖ Akin to subsidizing customers for energy efficiency, the utility could have existing customers pay some portion of the advanced contributions
 - The utility could argue that fuel switching would be net beneficial, has public benefits but is unaffordable to some prospective customers
- ❖ Why not then increase slightly the rates of existing customers so that prospective customers would switch to natural gas?
 - It may be more appropriate for the government to provide financial assistance to new customers
 - Especially if the line extension contributes to economic development in the rural area, funding with taxpayer money might be the preferred course
 - Instead of charging existing customers a higher rate, the utility could think of more accommodating ways for new customers to pay their advanced contributions (e.g., monthly payments over 5 years)

Specific Public Utility Commission Actions

- Promote fuel switching with the same vigor shown for energy efficiency
- Initiate workshops and technical conferences on fuel switching and gas line extensions
- Revisit long-standing rules, policies and tariffs
- Include fuel switching as a planning option
- Develop guidelines on:
 - ❖ Criteria for acceptable investments in pipe expansion
 - ❖ Commission procedures for reviewing and evaluating proposed expansions
 - ❖ Cost allocation
 - ❖ Ratemaking treatment of costs
 - ❖ Utility role

-
- Presentation adapted from the author's article
“Exploiting the Abundance of U.S. Shale Gas:
Overcoming Obstacles to Fuel Switching and Expanding
the Gas Distribution System.” *Energy Law Journal*, Vol.
34, No. 2, 2013.



NARUC Gas Staff Subcommittee
February 14, 2016

GET THE FACTS: <http://www.bcse.org/sustainableenergyfactbook>

#Factbook

About the BCSE

- The Business Council for Sustainable Energy (BCSE) is a coalition of companies and trade associations from the energy efficiency, natural gas and renewable energy sectors.
 - The Council advocates for policies at state, national and international levels that:
 - increase the use of commercially-available clean energy technologies, products and services
 - support an affordable, reliable power system
 - reduce air pollution & greenhouse gas emissions
-

2016 BCSE Members





2016

SUSTAINABLE ENERGY IN AMERICA

Factbook

Understanding the U.S. Energy Transformation

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It is a new era for American energy. In 2015, increased use of sustainable energy set the stage for a U.S. triple play of carbon reductions, cost savings and economic growth.

The 2016 edition of the Sustainable Energy in America Factbook – produced for the Business Council for Sustainable Energy by Bloomberg New Energy Finance, provides up-to-date, accurate market information about the broad range of industries — energy efficiency, renewable energy and natural gas — that are contributing to the country's move towards cleaner energy production and more efficient energy usage.

THE SUSTAINABLE ENERGY TRANSFORMATION

The energy productivity of the U.S. economy has **INCREASED BY 13%** from 2007 to 2015, and **2.3%** since 2014.



Get the **2016** Factbook



See State Spotlight

Browse the Brochure →



Watch the Video →



View the Slideshow →



Infographic



Get the Facts

- American energy productivity has increased by 13% from 2007 to 2015.
- 2015 was a record year for natural gas production, consumption, flows to power generation and volumes into storage.
- Renewable energy is a prominent part (20%) of the U.S. 2015 capacity mix, with 221GW installed across the country, a 57% increase over 2008 levels.
- Total U.S. investment in clean energy topped \$56 billion in 2015, the second highest level in the world.
- 2015 U.S. power sector carbon emissions fell to their lowest annual level since 1995.



Executive Summary



Industry Focus:

Energy Efficiency
Natural Gas
Renewable Energy

Quick Facts On:

Alternative Fuel Vehicles
Biomass/ Waste-to-Energy
Carbon Capture & Storage

Combined Heat & Power
Fuel Cells
Hydropower

State Spotlight

Learn about clean energy in the following states:

- Minnesota
- Nevada
- Pennsylvania
- Virginia
- See 2016 Factbook State & Regional Slides

Previous Factbook Editions

Download previous editions of the Factbook here.

2013



2014



2015



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The Business Council for
Sustainable Energy

Bloomberg New Energy Finance (BNEF) provides unique analysis, tools and data for decision makers driving change in the energy system. With unrivalled depth and breadth, BNEF helps clients stay on top of developments across the energy spectrum from our comprehensive web-based platform. BNEF has 200 staff based in London, New York, Beijing, Cape Town, Hong Kong, Munich, New Delhi, San Francisco, São Paulo, Singapore, Sydney, Tokyo, Washington D.C., and Zurich.

The Business Council for Sustainable Energy (BCSE) is a coalition of companies and trade associations from the energy efficiency, natural gas and renewable energy sectors. The Council membership also includes independent electric power producers, investor-owned utilities, public power, commercial end-users and project developers and service providers for energy and environmental markets.

2016

SUSTAINABLE ENERGY IN AMERICA

Factbook

The Business Council for
 **Sustainable
Energy®**

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About the Factbook (1 of 2): What is it and what's new

What is it?

- Aims to augment existing, reputable sources of information on US energy
- Focuses on **renewables, efficiency, natural gas**
- **Fills important data gaps** in certain areas (eg, investment flows by sector, contribution of distributed energy)
- Contains data through the end of 2015 wherever possible
- Employs **Bloomberg New Energy Finance data** in most cases, augmented by EIA, FERC, ACEEE, ICF International, LBNL, and other sources where necessary
- Contains the very **latest information on new energy technology costs**
- Has been graciously underwritten by the **Business Council for Sustainable Energy**
- Is in its **fourth edition** (first published in January 2013)

What's new?

- **Format:** This year's edition of the Factbook (this document) consists of Powerpoint slides showing updated charts. For those looking for more context on any sector, the 2014 edition⁽¹⁾ can continue to serve as a reference. The emphasis of this 2016 edition is to *capture new developments that occurred in the past year*.
- **Updated analysis:** Most charts have been extended by one year to capture the latest data.
- **2015 developments:** The text in the slides highlights major changes that occurred over the past year.
- **New coverage:** This report contains data shown for the first time in the Factbook, including analyses of US levelized costs of electricity, corporate renewables procurement, US transmission build, small-scale CHP generation and additional energy efficiency data.

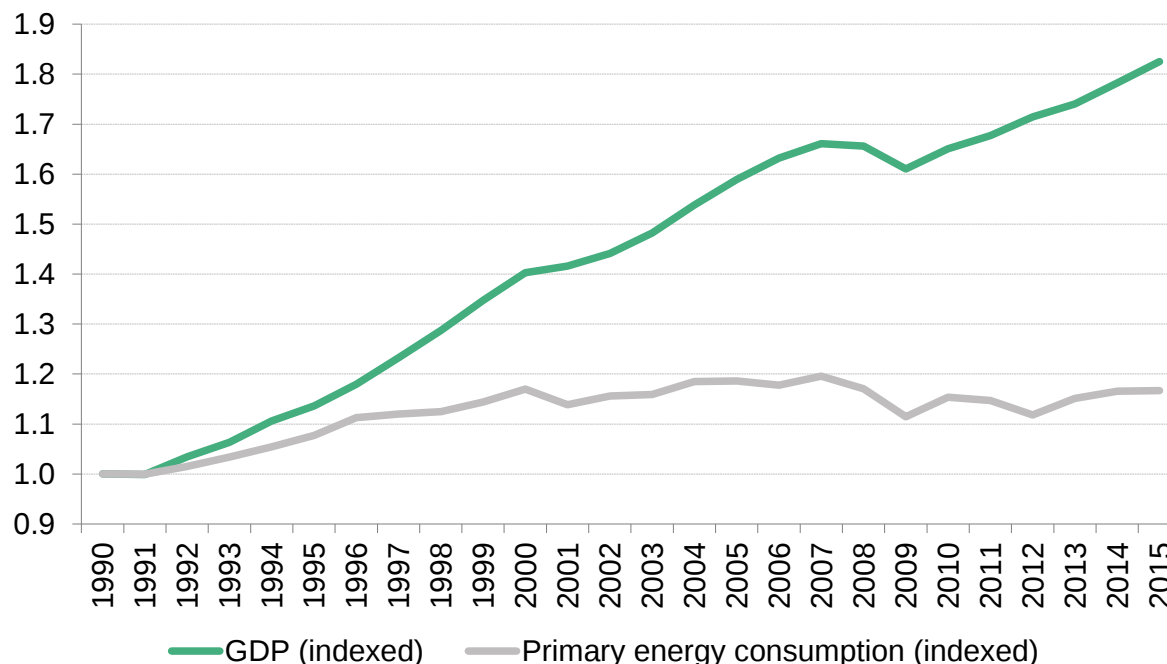
(1) The 2014 Factbook can be found here: <http://www.bcse.org/factbook/pdfs/2014%20Sustainable%20Energy%20in%20America%20Factbook.pdf>



2015: A YEAR OF MILESTONES

Bloomberg
NEW ENERGY FINANCE

Economy's energy productivity: GDP and primary energy consumption (indexed to 1990 levels)

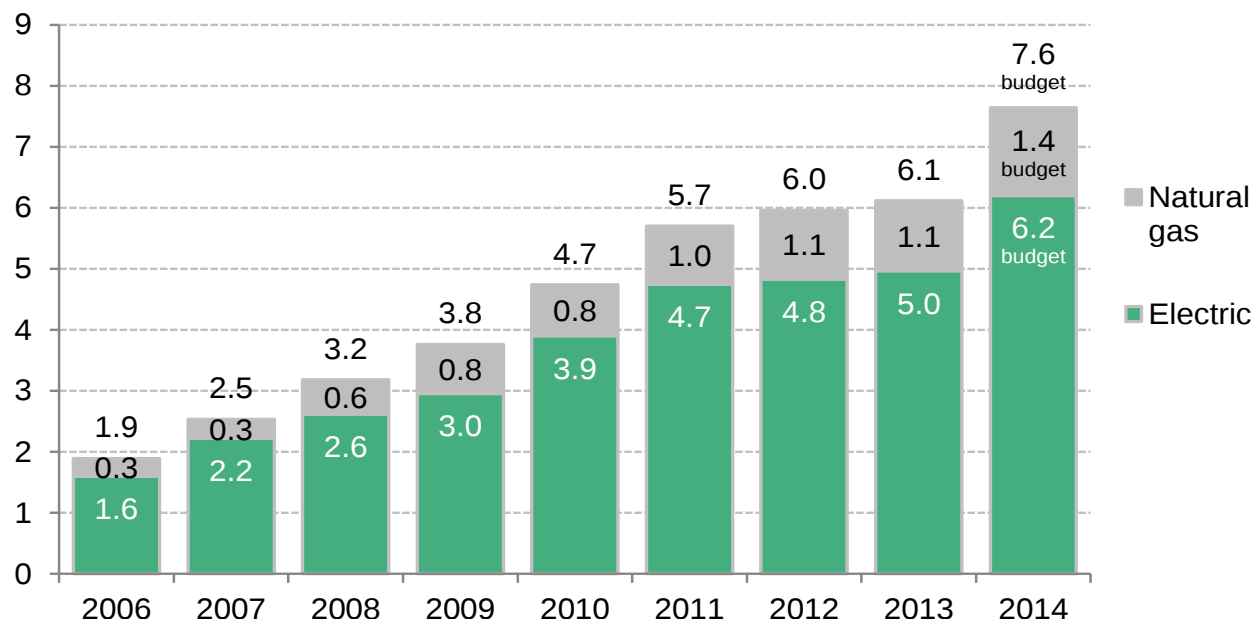


- The US economy is increasingly energy productive, resulting in a decoupling between growth in GDP and growth in energy consumption. As US GDP expanded 83% over the last 25 years, energy consumption only ticked up 17%.
- By one measure (US GDP per unit of energy consumed), productivity has improved 56% since 1990, 13% since 2007, and 2.3% between 2014 and 2015.

Source: US Energy Information Administration (EIA), Bureau of Economic Analysis, Bloomberg Terminal

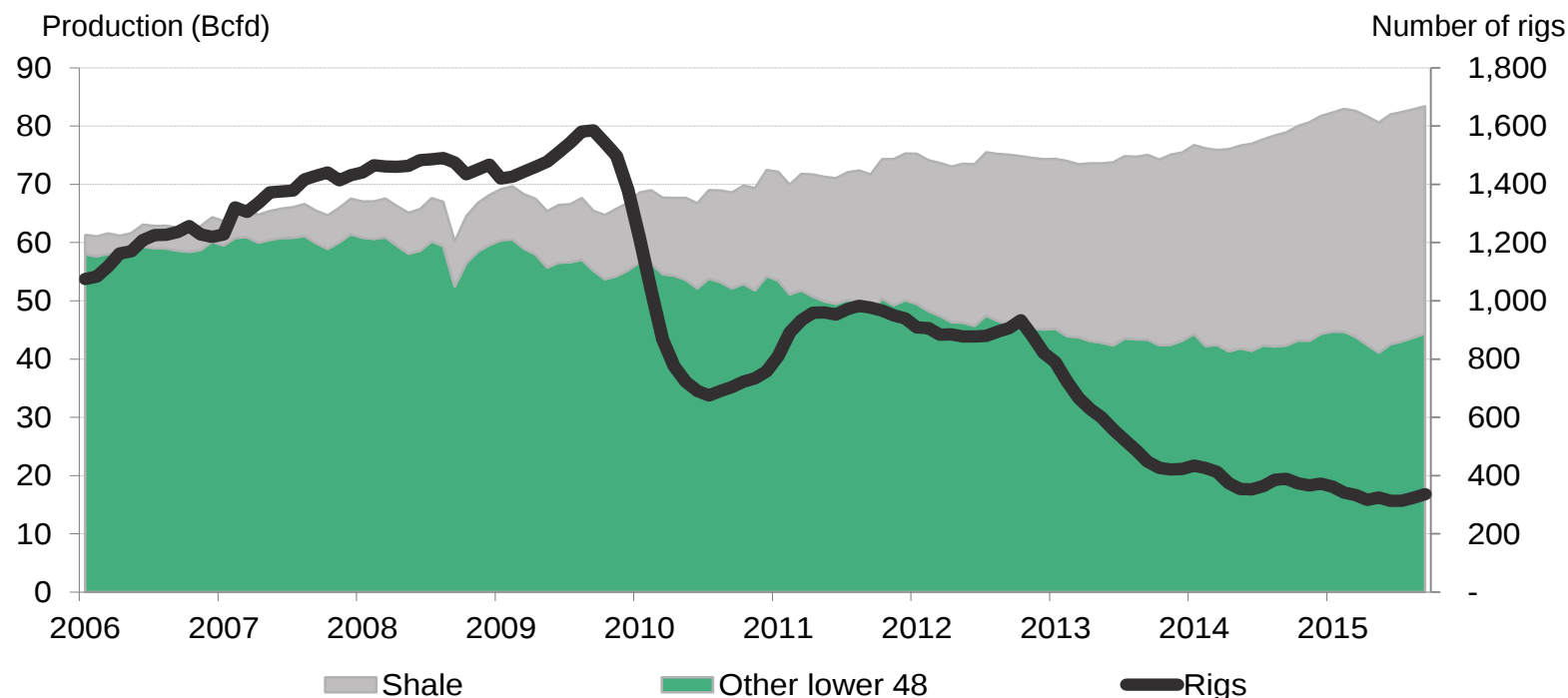
Notes: Values for 2015 energy consumption are projected, accounting for seasonality, based on latest monthly values from EIA (data available through September 2015). GDP is real and chained (2009 dollars); annual growth rate for GDP for 2015 is based on consensus of economic forecasts gathered on the Bloomberg Terminal as of January 2016.

Financing: US utility energy efficiency spending and budgets (\$bn)



- From 2006 to 2011, US utility expenditure for energy efficiency grew 25% per year.
- The budgeted amount for 2014 would represent a 25% growth between 2013 and 2014.
- Maryland was the state with the largest increase in utility budgets for energy efficiency, with an increase from \$119m in 2013 to \$292m in 2014.
- In December 2015, US Congress renewed the energy-efficient commercial buildings tax deduction and nonbusiness (ie, residential) Energy-efficient Property Credit that retroactively reinstates tax credits for projects completed in 2015 and 2016.

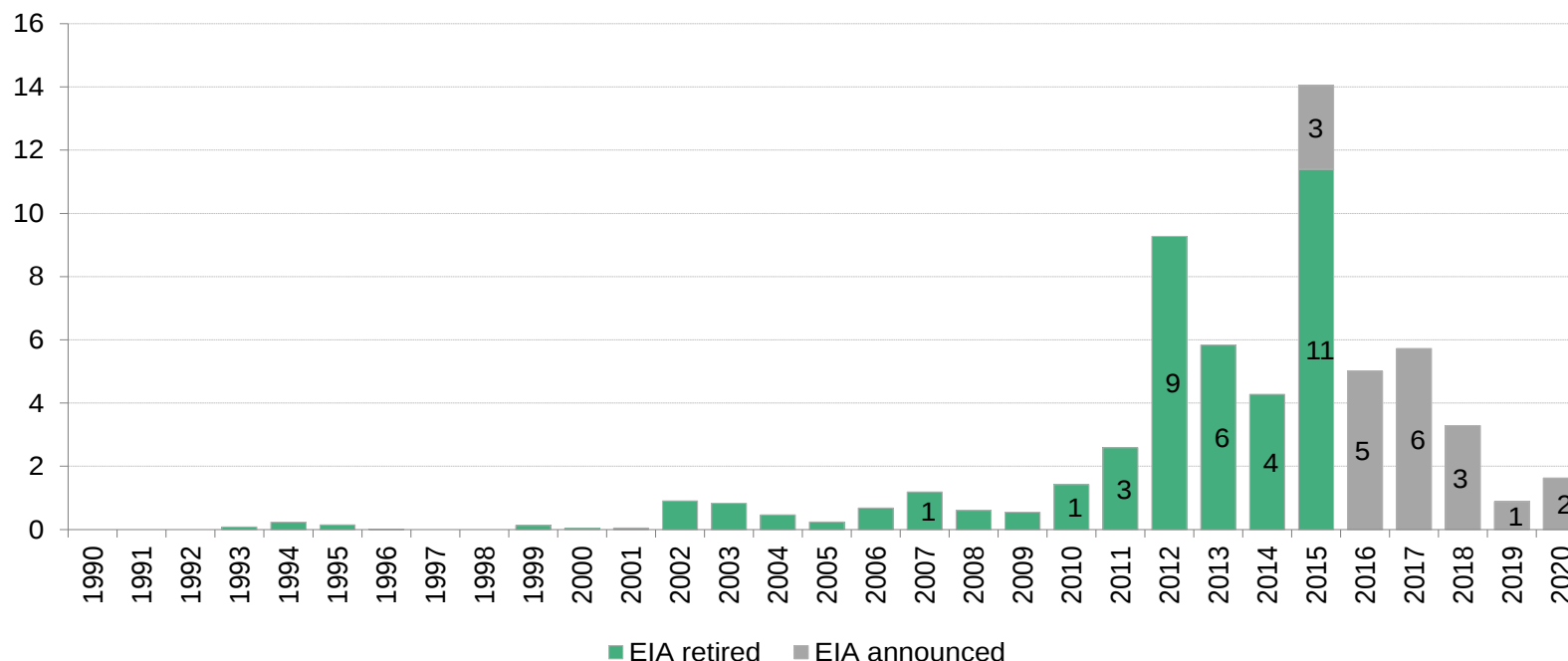
Deployment: US natural gas production and gas-directed rig count (Bcfd, rigs)



- Natural gas production in 2015 was up 7% from 2014 levels, 26% from 2007 levels. Shale production now accounts for almost half of total.
- Technological improvements in efficiencies (like pad drilling and longer laterals) and drilling in productive “sweet spots” has allowed production to increase even as rig counts drop.

Source: Bloomberg New Energy Finance, EIA, Baker Hughes. Data up through the latest comprehensive numbers available (September 2015).

Policy: US coal power plant retirements completed and announced by year (GW)

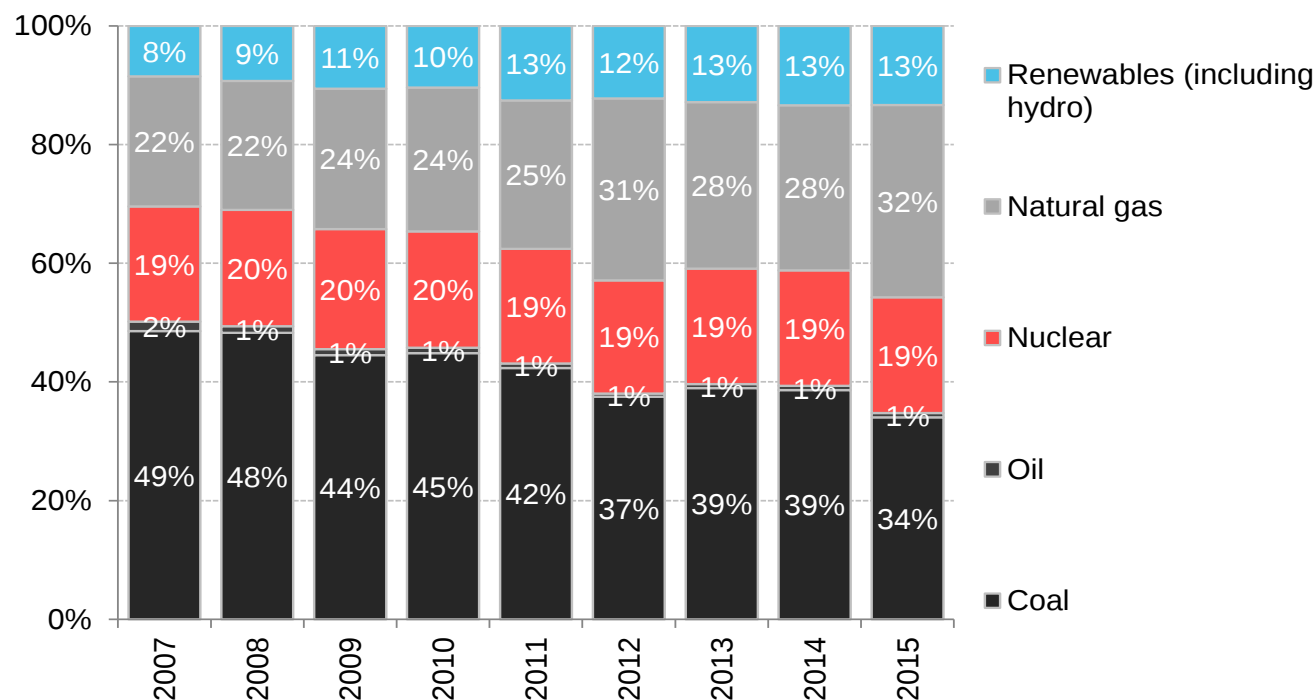


- 2015 saw the largest wave of coal retirements ever, with 11GW going offline through October 2015 and another 3GW of retirements announced. An additional, undetermined number of plants (likely less than 5GW in total) also converted from coal to burn natural gas and, in a few cases, biomass.
- Record low gas prices, old age, and increasing operating costs – partly due to US Environmental Protection Agency (EPA) regulations covering sulfur, nitrogen, and mercury emissions from power plants – have forced many coal plants to retire earlier than originally planned.

Source: Bloomberg New Energy Finance

Notes: "Retirements" does not include conversions from coal to natural gas or biomass; retirement numbers through end-October 2015.

US energy overview: US electricity generation by fuel type (%)



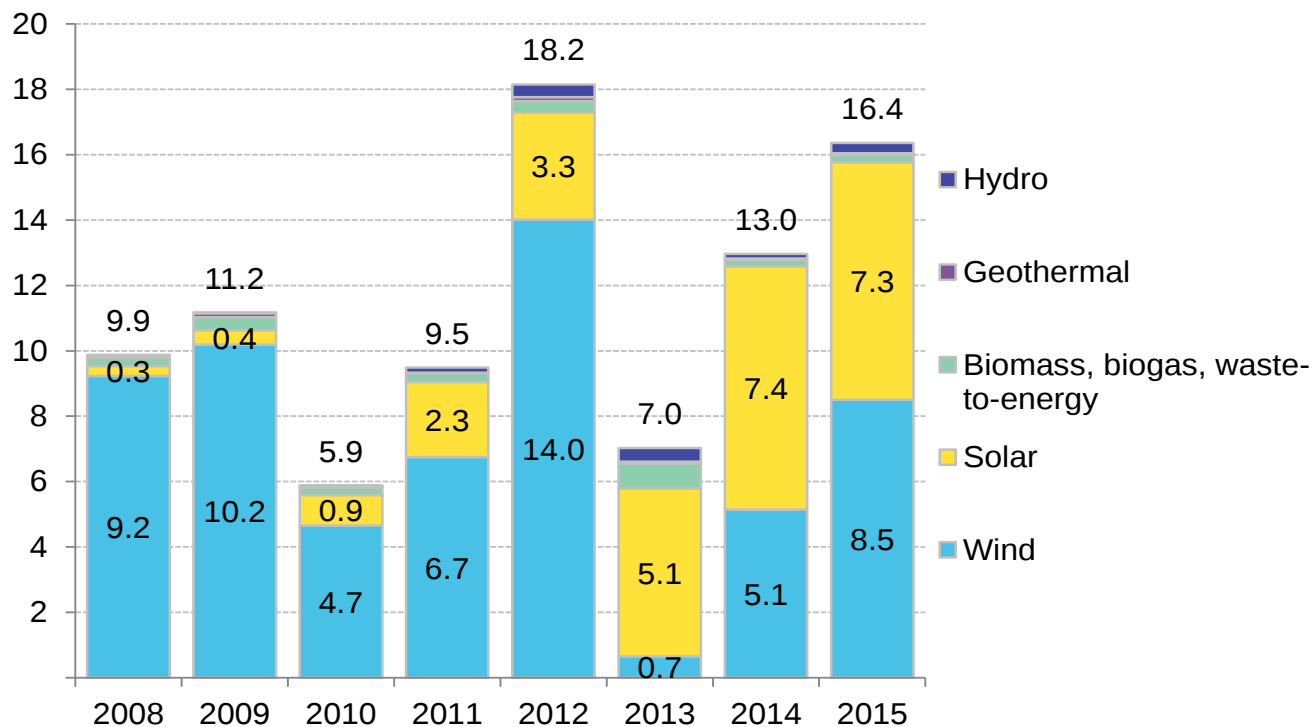
- Generation from natural gas plants increased by 17% from 2014 to 2015, while coal generation fell by 11%.
- The US power sector is gradually decarbonizing. From 2007 to 2015, natural gas increased from 22% to 32% of electricity generation, and renewables climbed from 8% to 13%. Coal's share slipped from 49% in 2007 to only 34% in 2015.

Source: EIA

Notes: Values for 2015 are projected, accounting for seasonality, based on latest monthly values from EIA (data available through October 2015). In chart at left, contribution from 'Other' is not shown; the amount is minimal and consists of miscellaneous technologies including hydrogen and non-renewable waste. The hydropower portion of 'Renewables' includes negative generation from pumped storage.

US energy overview:

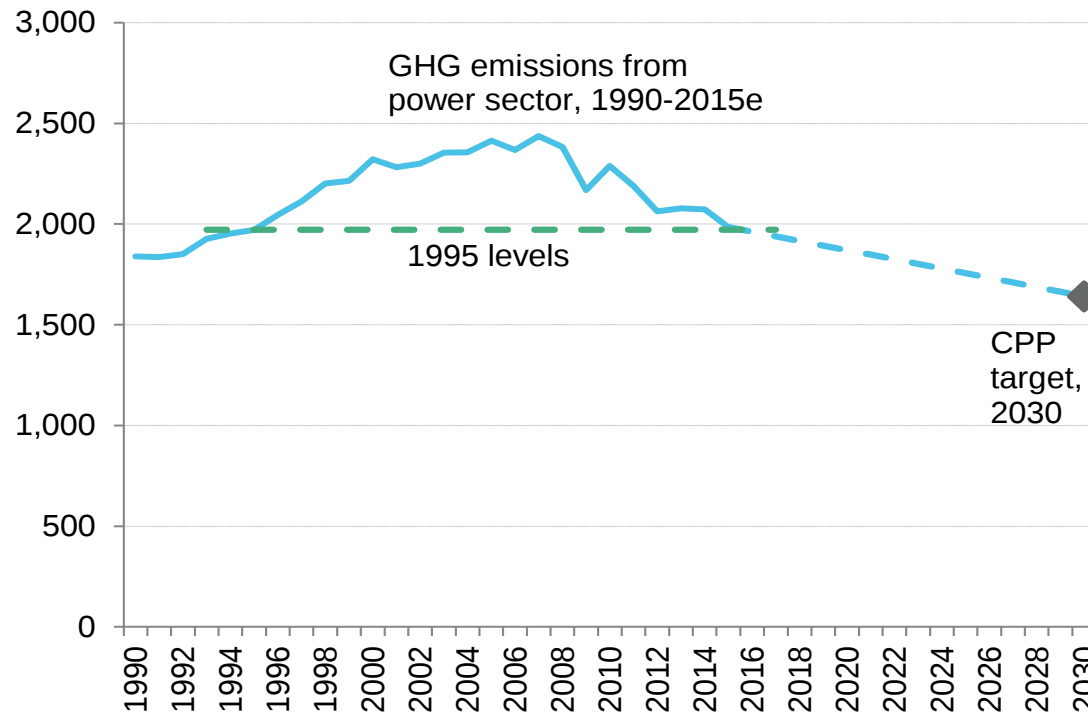
Renewable energy capacity build by technology (GW)



- Solar experienced another year of strong build, adding 7.3GW of PV in 2015 – a record.
- Small-scale solar continues to grow as the economics make it a viable alternative to retail rates in many regions of the country.
- Wind build surged to 8.5GW in 2015 as developers rushed to capture the Production Tax Credit (PTC) before it was due to expire at the end of 2016.
- Other sectors (biomass, biogas, waste-to-energy, geothermal, hydro) are idling without long-term policy support.

Source: Bloomberg New Energy Finance, EIA Notes: Numbers include utility-scale (>1MW) projects of all types, rooftop solar, and small- and medium-sized wind.

US energy overview: Greenhouse gas emissions from the power sector (MtCO₂e)



- In 2015, power-sector emissions sunk to their lowest levels (1,985Mt) since 1995 as cleaner-burning natural gas has displaced generation from coal-fired power plants.
- Emissions are 18% below 2005 levels.
- The Clean Power Plan targets a 32% cut from 2005 levels by 2030.

Source: Bloomberg New Energy Finance, EIA, EPA

Notes: Values for 2015 are projected, accounting for seasonality, based on latest monthly values from EIA (data available through September 2015).

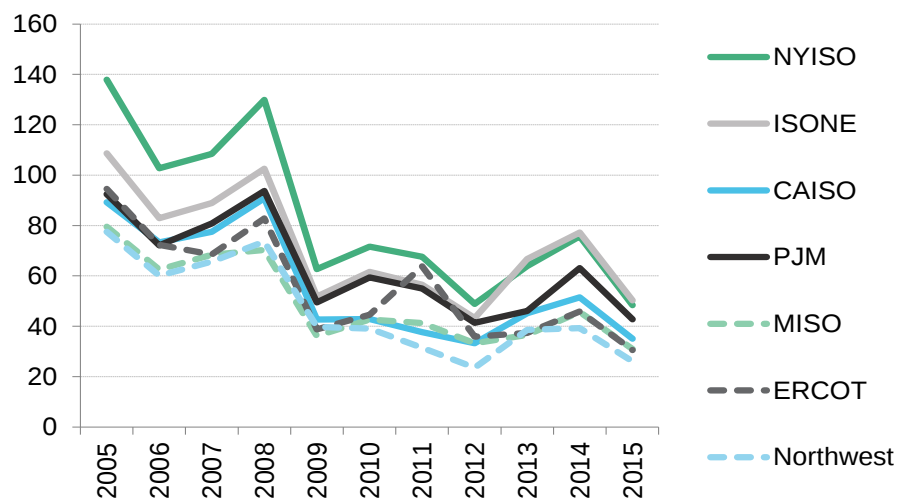


AN ERA OF LOW PRICES

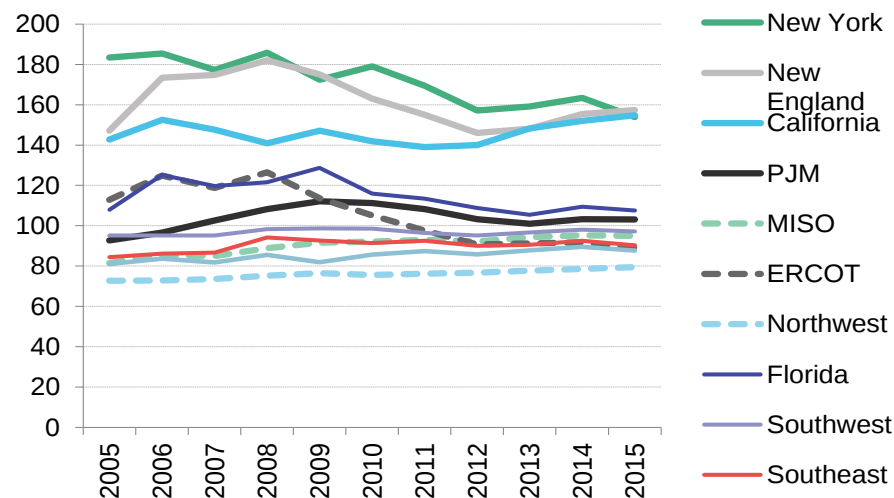
Bloomberg
NEW ENERGY FINANCE

US energy overview: Retail and wholesale power prices

Wholesale power prices (\$/MWh)



Average retail power prices (\$/MWh)



- Wholesale prices fell by about a third in 2015, as natural gas prices fell and more renewables connected to the grid.
- Retail power prices in most regions remain well below the peak prices seen in 2008-09.
- In 2015, retail electricity rates fell by 1.3% on average nationwide. New York (-5.8%) and Texas (-2.7%) saw the biggest year-on-year declines.
- Exceptions included California and New England where retail prices rose marginally (1.8% and 1.3%, respectively).

Source: Bloomberg New Energy Finance, EIA, Bloomberg Terminal Notes: Data through end-November 2015. Wholesale prices taken from proxy power hubs in each ISO. Prices are in real 2014 dollars.



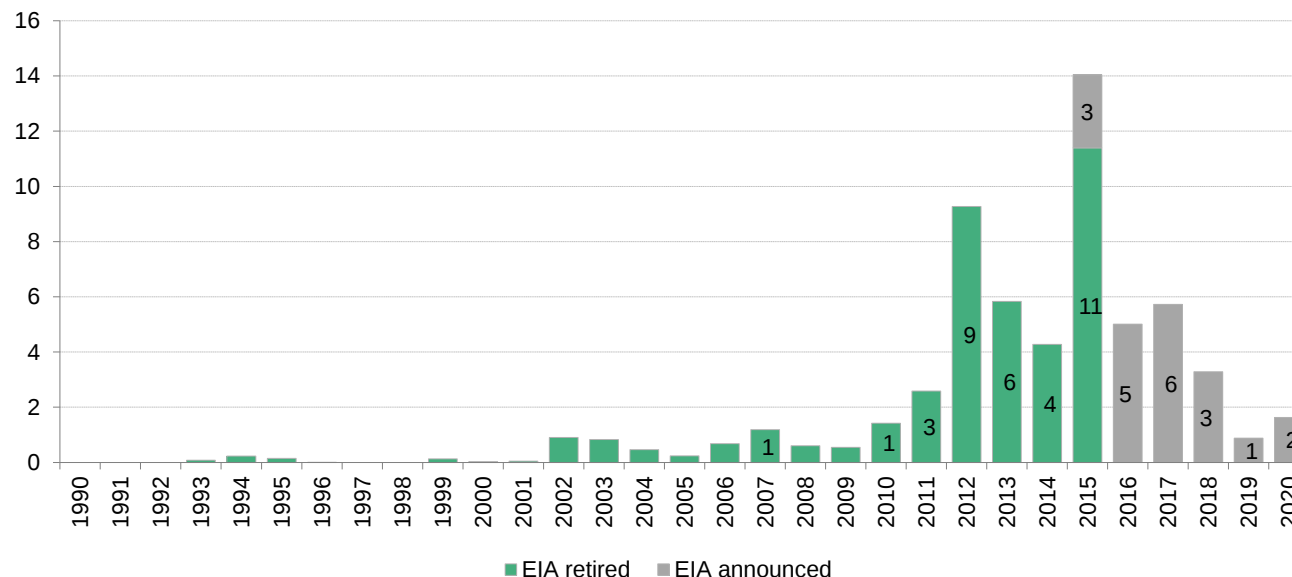
WRAP-UP

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Wrap-up

- **2015 was a watershed year for sustainable energy in the US:**
 - GDP grew 2.4%, while energy consumption grew only 0.1%
 - Record natural gas production and consumption
 - Record coal retirements (14GW+)
 - Record solar PV build (7.3GW)
- **These changes are signs of a permanent shift:**
 - Natural gas has been displacing coal within the power sector
 - Renewables (excluding hydro) provided 7.4% of power, up from 2.2% in 2005
 - Power sector emissions 18% below 2005 levels
 - Hybrid vehicle sales fell and gasoline consumption rose, but long-term trend still positive
- **Meanwhile, energy prices remain low:**
 - Natural gas prices hit lowest levels since 1999, allowing gas to outcompete coal
 - Solar, wind costs continue to decline
 - Retail power prices 6% below 2008 peak
- **And the outlook is strong:**
 - US remains key destination for clean energy investment
 - Critical policy developments (Paris, Clean Power Plan, tax credit extensions)

Policy: US coal power plant retirements completed and announced by year (GW)

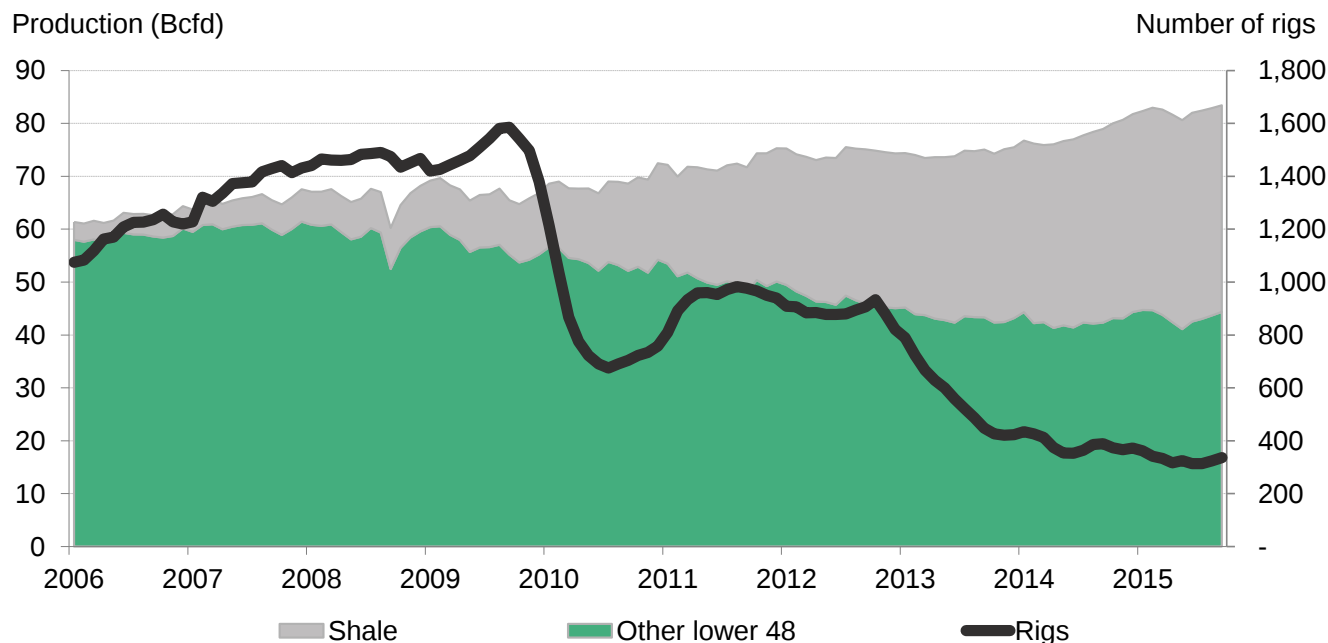


- 2015 saw the largest wave of coal retirements ever, with 11GW going offline through October 2015 and another 3GW of retirements announced. An additional, undetermined number of plants (likely less than 5GW in total) also converted from coal to burn natural gas and, in a few cases, biomass. Much of the action was driven by utilities responding to the Mercury and Air Toxics Standard (MATS) which was due to take effect in April 2015.
- Record low gas prices, old age, and increasing operating costs – partly due to US Environmental Protection Agency (EPA) regulations covering sulfur, nitrogen, and mercury emissions from power plants – have forced many coal plants to retire earlier than originally planned.
- MATS was put into limbo after it was remanded by the US Supreme Court in summer 2015. But remaining regulations, coupled with the Clean Power Plan and New Source Performance Standards for new coal and gas build, continue to drive up costs for existing coal plants and effectively preclude new build of coal plants without carbon capture and storage.

Source: Bloomberg New Energy Finance, EIA

Notes: "Retirements" does not include conversions from coal to natural gas or biomass; includes retirements or announced retirements reported to the EIA through end-October 2015.

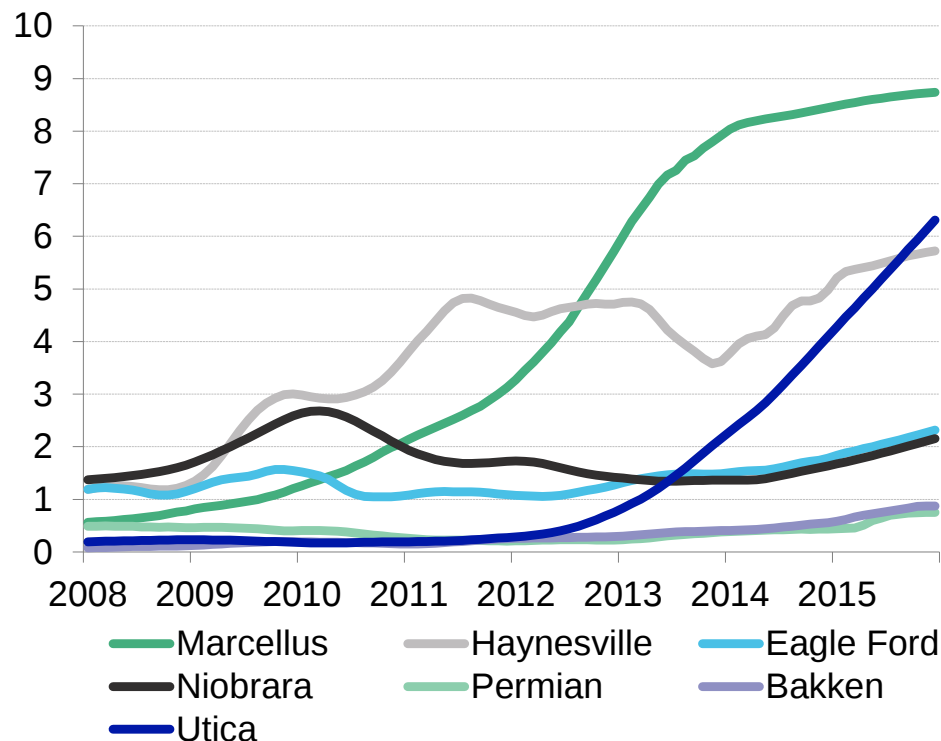
Deployment: US natural gas production and gas-directed rig count (Bcfd, rigs)



- Rig counts have dropped even lower than last year, as producers struggle to cope with the low-price environment.
- However, total US natural gas production still continues to grow. This is due to a few reasons:
 - Producers are selectively drilling in productive “sweet spots.”
 - Technological improvements in efficiencies (like pad drilling and longer laterals) are effective in shrinking well completion time, making it easier to speed up production and expand capacity for each well.
 - Further pipeline build, including new infrastructure brought online in November and December, will expand takeaway capacity, reducing supply gluts and pushing up prices. In the latter part of last year, producers were bringing back shut-in wells in response to potentially higher cash prices.

Source: Bloomberg New Energy Finance, EIA, Baker Hughes. Data up through the latest comprehensive numbers available (September 2015).

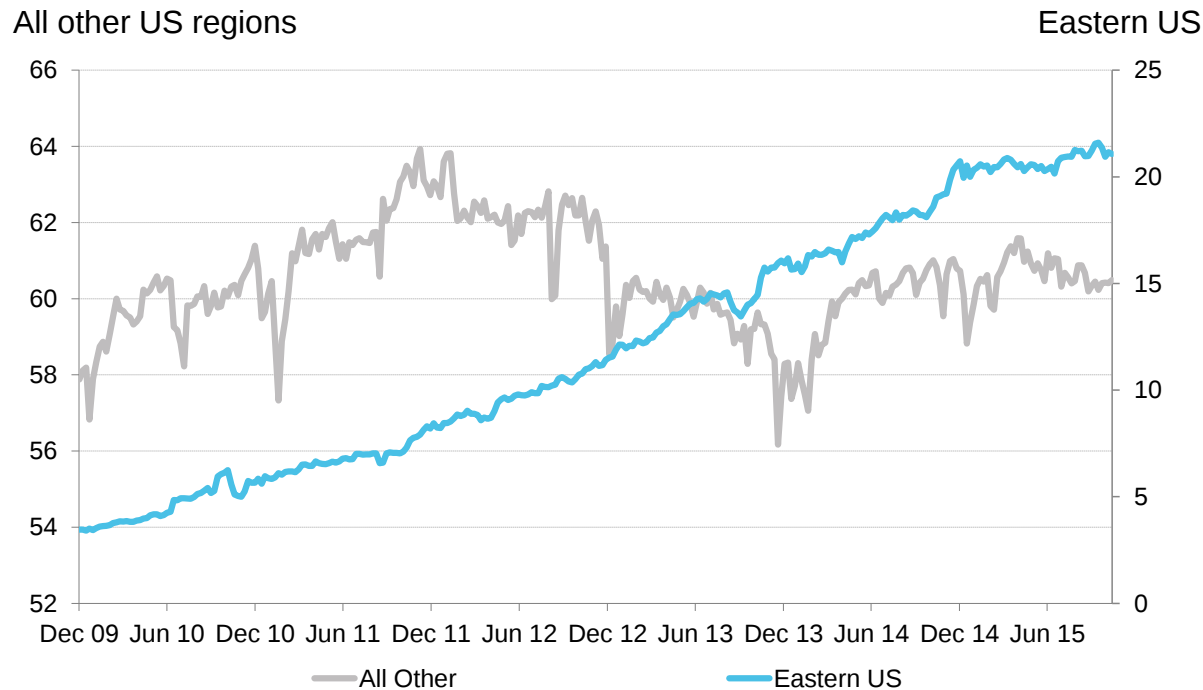
Deployment: US natural gas productivity (production per rig) by shale formation (MMcfd)



- The Marcellus is the most productive gas play in the US and by itself offsets declining dry gas production in other parts of the country. The most economical dry and wet gas regions are located here, and the area experienced the greatest rig productivity improvement.
- Utica productivity has also been exceptional in the past few years, having just exceeded the Haynesville during this past year.

Source: Bloomberg New Energy Finance, EIA

Deployment: Gas production in the continental US (Bcfd)



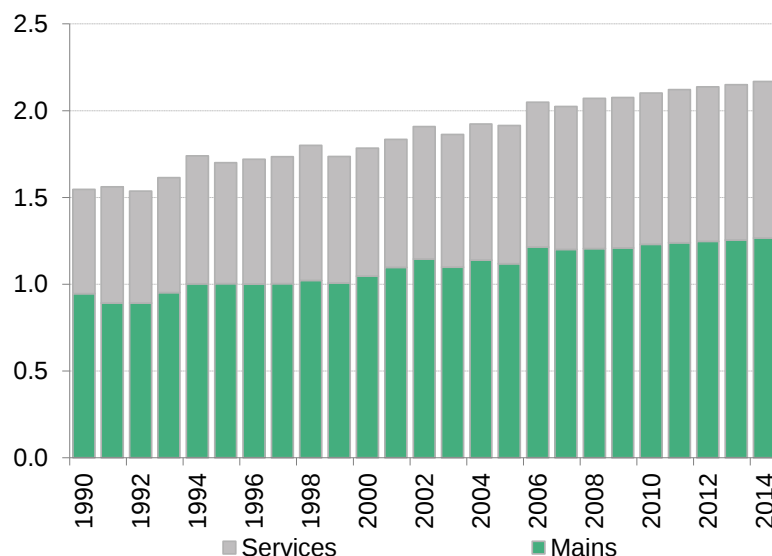
- Eastern US natural gas production continues to grow, even as producers shut wells to ride out unfavorable economics caused by the lack of takeaway capacity.
- Production in other plays was fairly stagnant in 2015 because the current low oil and gas price environment renders many plays uneconomical, and the Northeast has become a net supplier, in light of all the new pipeline projects and reversals emerging out of the region.

Source: Bloomberg New Energy Finance, LCI Energy

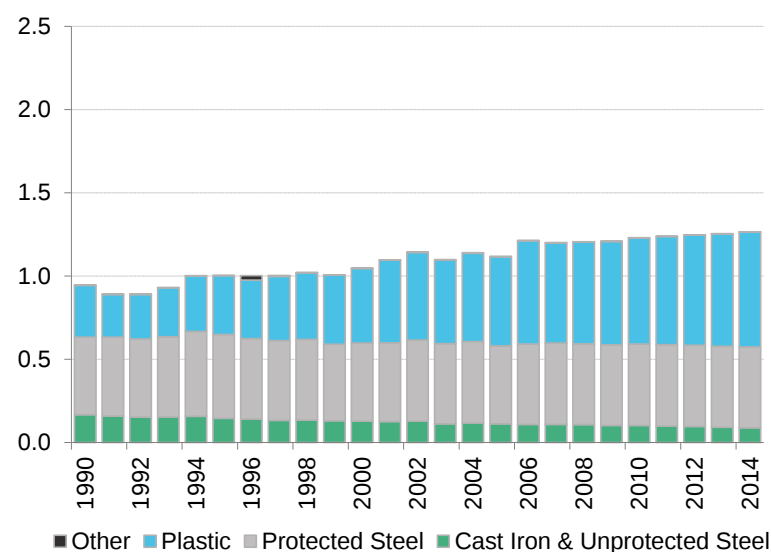
Notes: Eastern US production is mostly comprised of output from the Marcellus and Utica shales.

Deployment: US natural gas pipeline installations and materials (million miles)

US existing natural gas distribution pipeline



US natural gas distribution mainline material

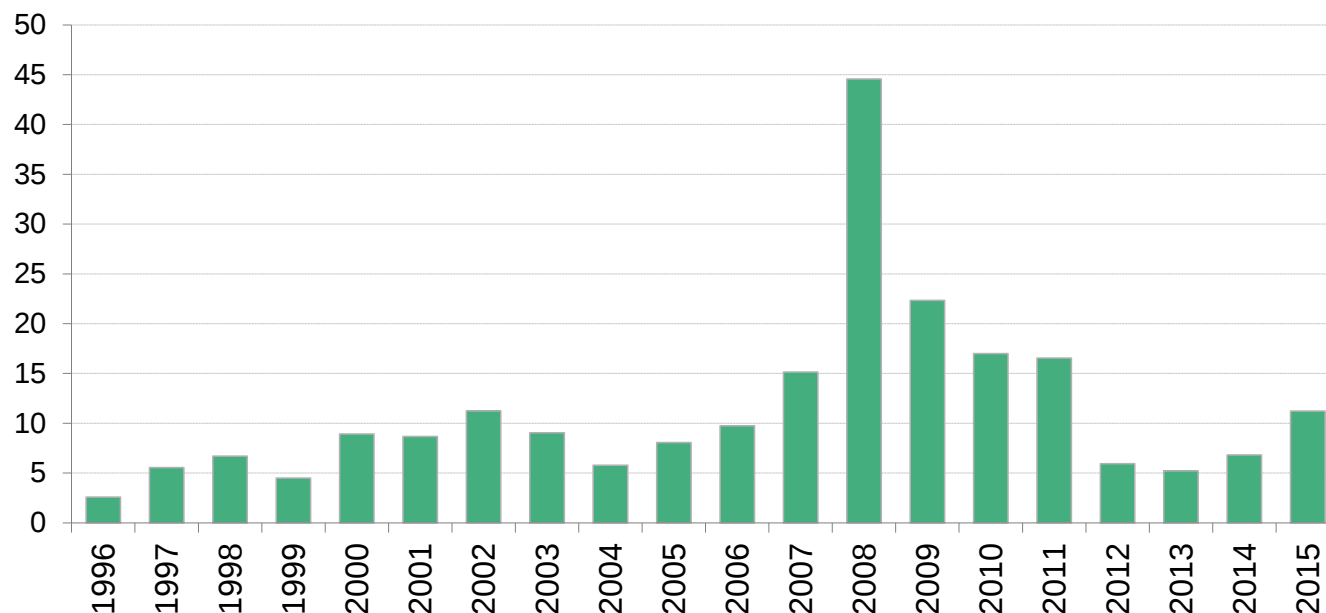


- Service and distribution pipelines – which bring gas from transmission lines to end-users – continue to grow steadily.
- Replacement and expansion efforts are upgrading US pipelines with more modern materials and expanding to underserved and unserved customers. Companies are removing older networks which are made from cast iron and unprotected steel and replacing them with newer plastic / protected steel pipes that are less susceptible to leaks. At the same time, more miles of pipeline are added to connect new customers.

Source: Bloomberg New Energy Finance, US Department of Transportation, American Gas Association

Notes: 'Mains' refers to pipelines to which customers' service lines are attached; 'Services' refer to pipes which carry gas from the distribution pipelines to the customer's meter. Numbers are not yet available for 2015.

Deployment: US transmission pipeline capacity additions (Bcfd)

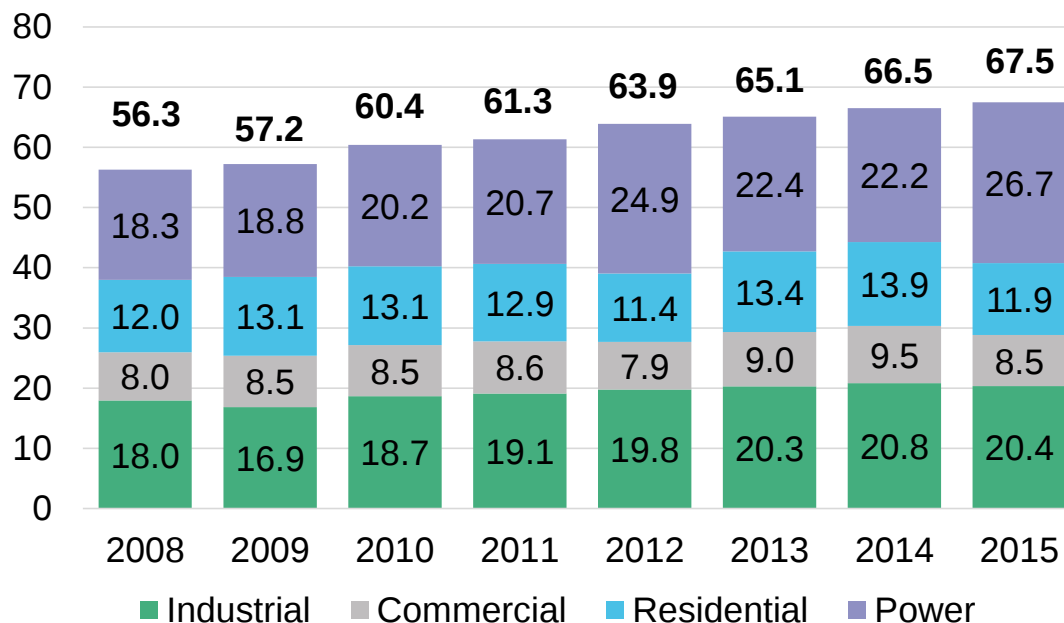


- In 2015, pipeline companies installed over 11Bcfd of total pipeline capacity, of which 3.3Bcfd provided first-mile takeaway capacity from Marcellus and Utica shales. Directionally, these first-mile pipelines will transport around 1.6Bcfd to Midwest markets, 1.1Bcfd towards the Gulf Coast, and around 0.5Bcfd to the Southeast.
- Despite routine delays on pipeline projects (over almost all phases of the implementation process), many substantial projects were approved or filed for approval this year. The bulk of these projects will commence service in 2017 and 2018.
- US-Mexico border capacity in 2015 grew to just over 7Bcfd. Moving forward, capacity will be growing at unprecedented rates, with proposed capacity in 2019 reaching over 13Bcfd.

Source: Bloomberg New Energy Finance, EIA

Note: EIA data used here includes both first-mile takeaway capacity and other pipeline additions that do not impact takeaway capacity.

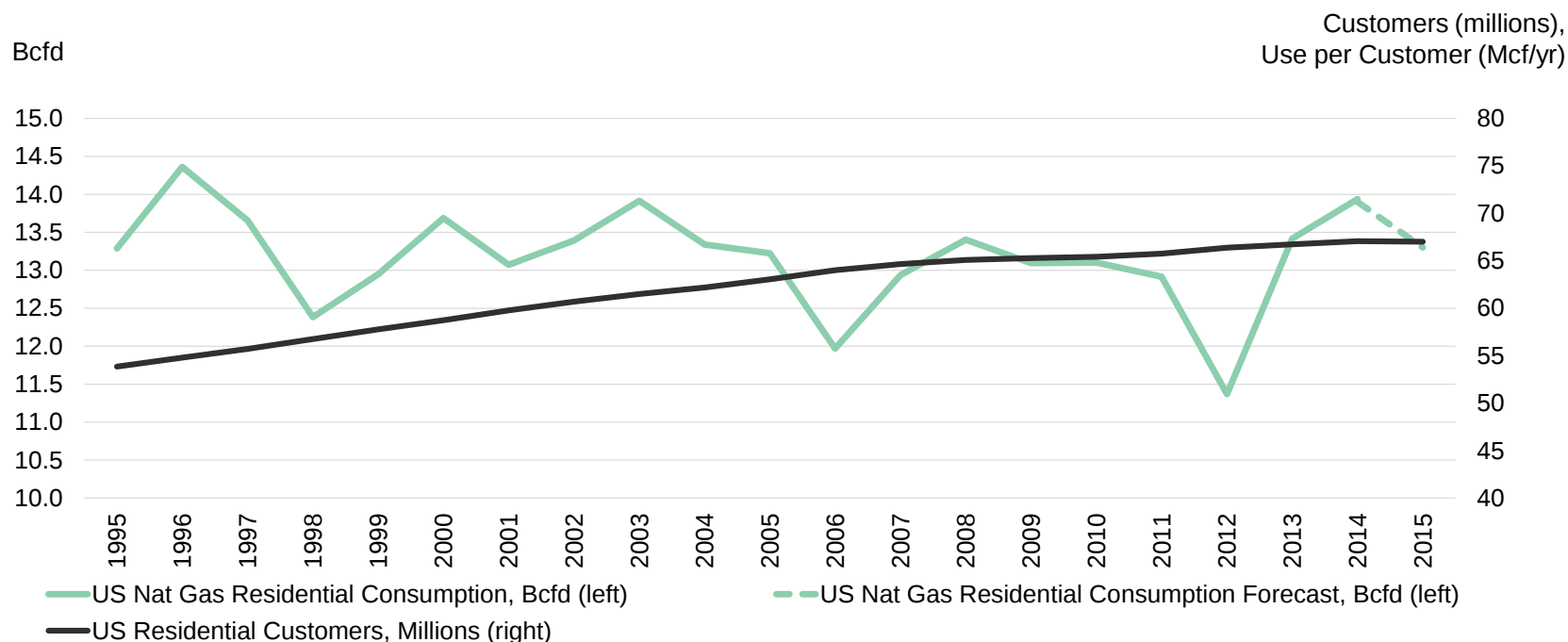
Deployment: US natural gas demand by end use (Bcfd)



- Total US annual gas demand has grown steadily: 2015's level represents a 15.4% increase since 2008, and an estimated 1.5% increase since 2014.
- Over the last year, power generation demand has seen the greatest increase (>20%) by far. We attribute this to structural reasons:
 - Natural gas has entered a prolonged low-price era, supported by high production volumes which are stranded behind constrained pipeline takeaway capacity.
 - Aggressive coal-to-gas conversions and coal retirements.
- Beginning 2016, LNG exports will become a large part of new demand.

Source: Bloomberg New Energy Finance, EIA

Deployment: US natural gas residential customers vs. residential consumption

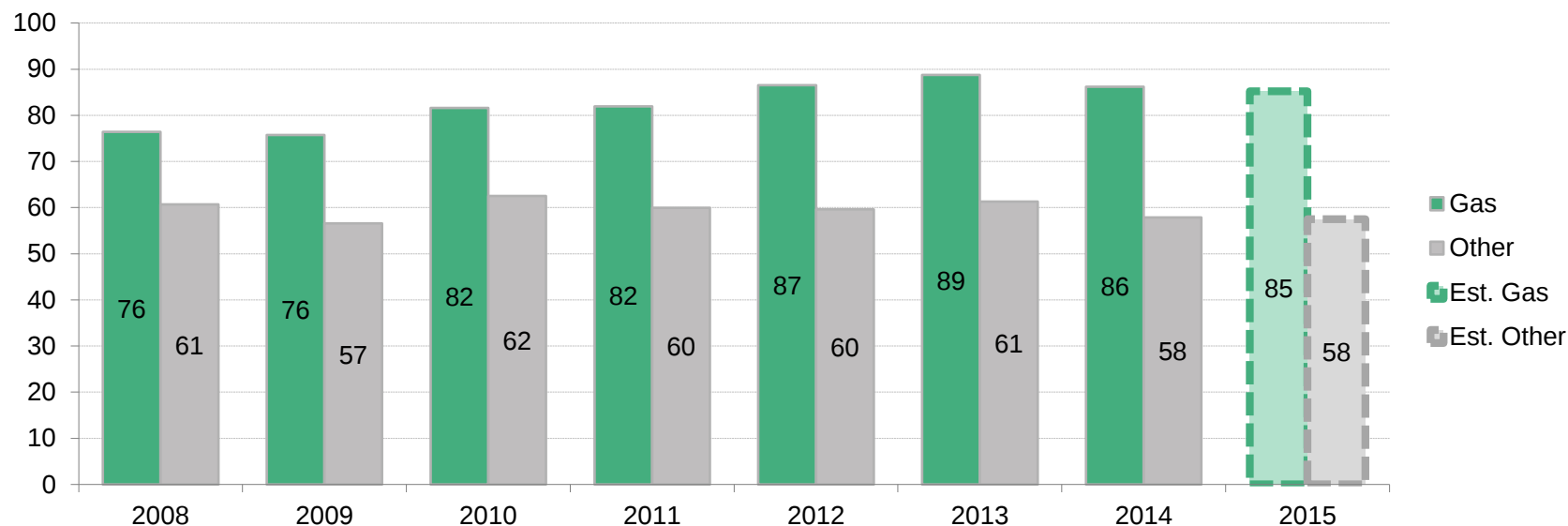


- Due to energy efficiency efforts, residential consumption has fallen even as more customers join the gas network. Per capita consumption has fallen steadily since the mid-1990s.
- Consumption dropped during the abnormally mild winter of 2011-12, but a return to more normal winter temperatures and increased heating demand during the polar vortices increased consumption in 2013 and 2014.
- Estimated residential consumption in 2015 was lower than in 2014 because of milder winter temperatures.

Source: Bloomberg New Energy Finance, EIA

Notes: Values for 2015 are projected, accounting for seasonality, based on latest monthly values from EIA (data available through September 2015).

Deployment: US industrial electricity production from on-site generation by source (TWh)

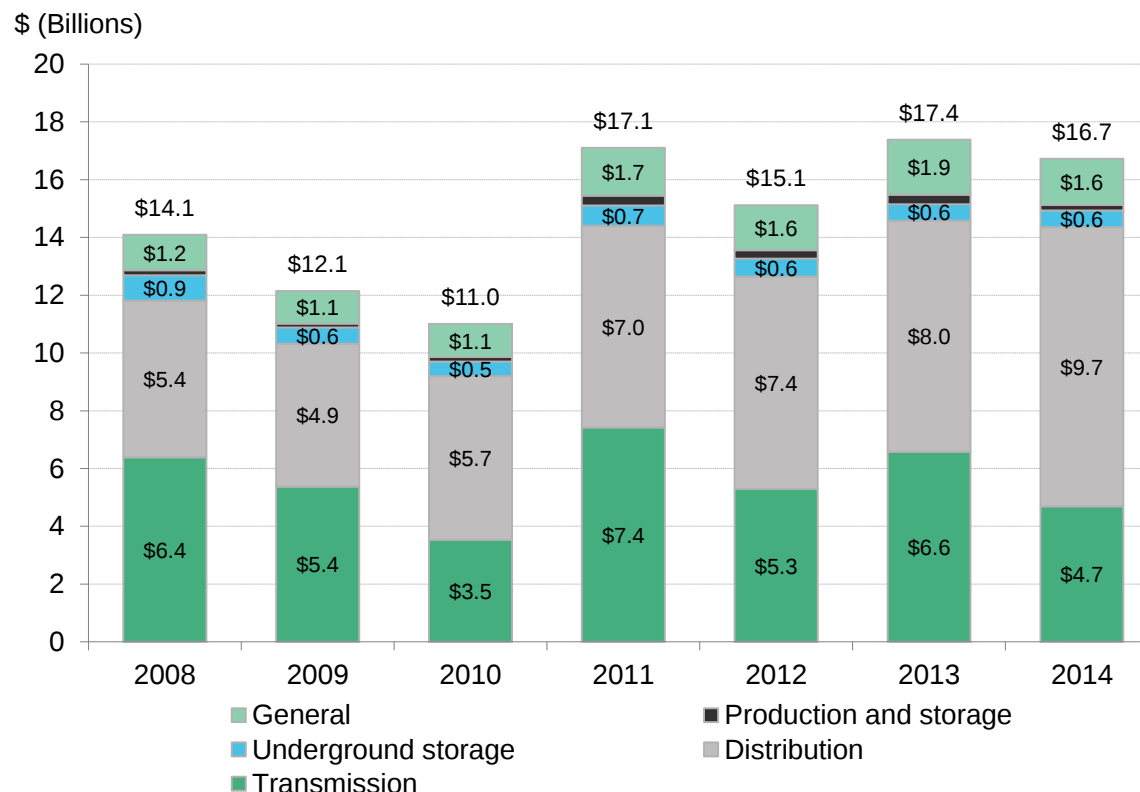


- Rising industrial sector on-site generation has boosted electric sector gas consumption since 2008.
- However, across all fuels, growth in industrial sector on-site generation has lost some momentum over the last few years.
- In 2014, the industrial sector saw a noticeable drop in on-site generation from gas. This recent blip is expected to reverse in the next few years, as new facilities—especially new chemical and fertilizer plants—come online.
- In 2015, natural gas was responsible for approximately 85TWh worth of on-site generation, with 58TWh provided by other sources.

Source: Bloomberg New Energy Finance, EIA

Notes: Values for 2015 are projected, accounting for seasonality, based on latest monthly values from EIA (data available through September 2015).

Financing: US midstream gas construction expenditures (\$bn)

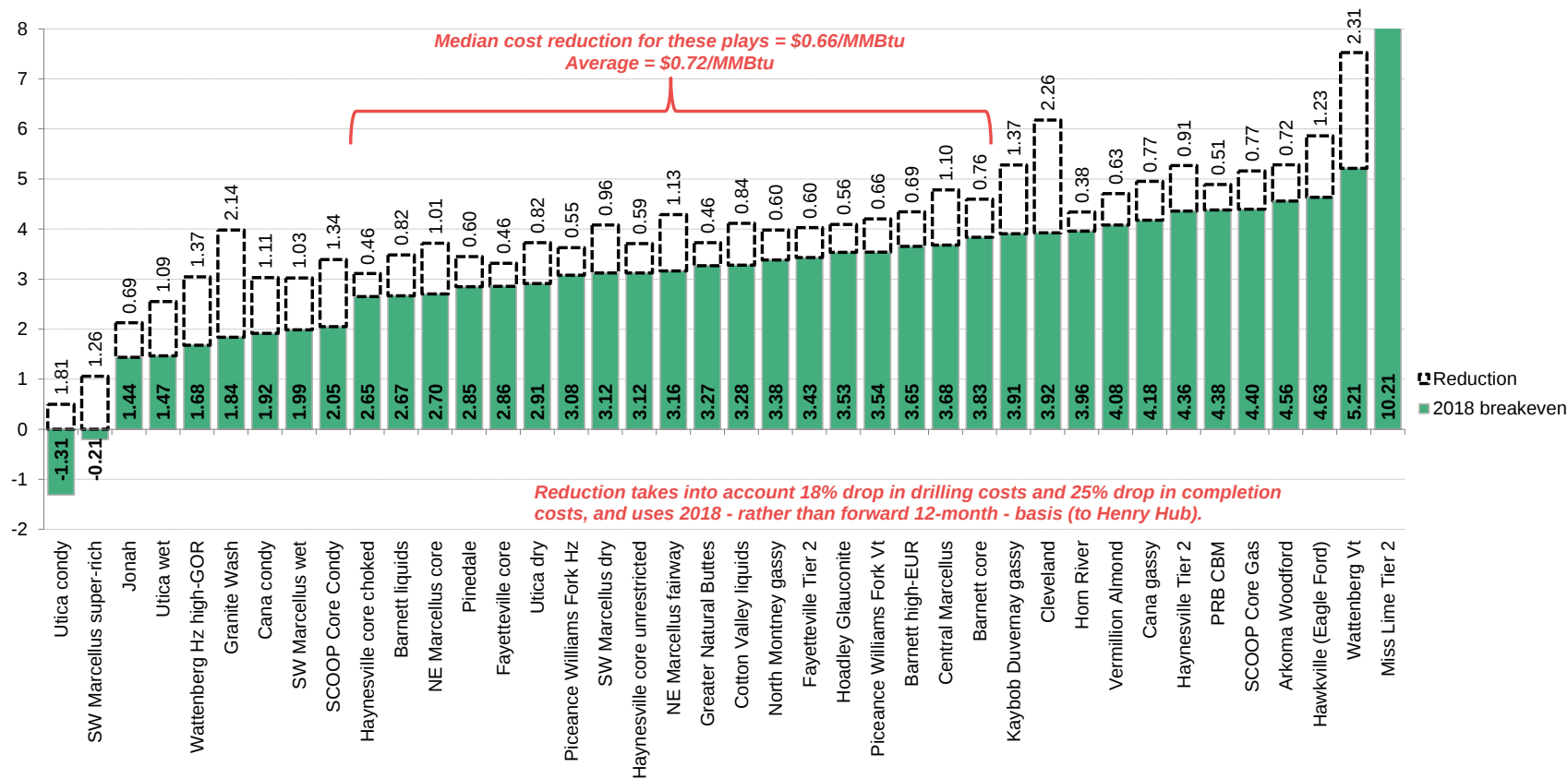


- While total midstream expenditures decreased in 2014, investments into pipeline distribution rose over 20%.
- This suggests that midstream companies and local distribution companies (LDCs) anticipate additional natural gas hookups for new and existing customers from new and expanding interstate pipelines.

Source: Bloomberg New Energy Finance, American Gas Association

Notes: Values reflect expenditures reported to the AGA by different types of companies across the supply chain, including transmission companies, investor-owned local distribution companies, and municipal gas utilities. 'General' includes miscellaneous expenditures such as construction of administrative buildings. Totals may not sum due to rounding.

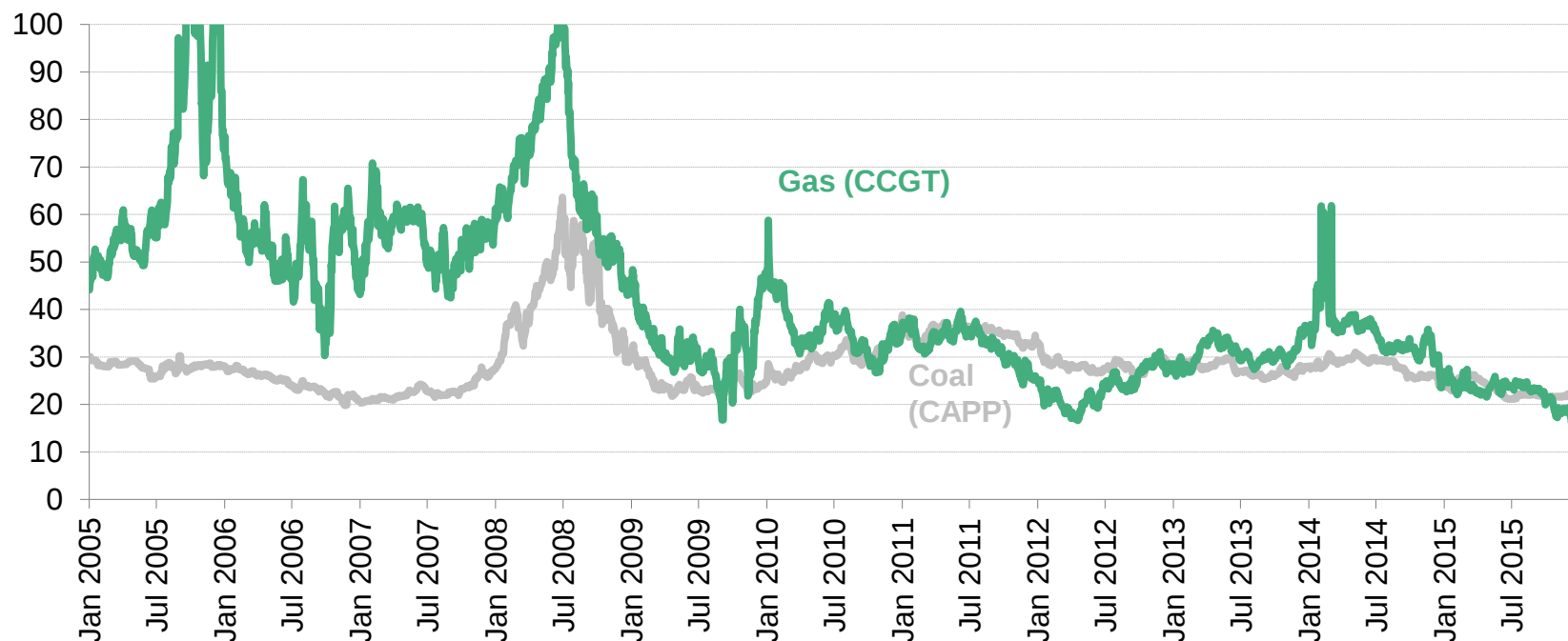
Economics: Gas breakevens before and after the oil rout (\$/MMBtu)



- Reduction in drilling and completion (D&C) activity since the oil price collapse has resulted in falling service costs.
- Anecdotally, drilling costs have fallen by ~18% since Q4 2014 and that completion costs have fallen by ~25%.
- Given that D&C costs represent the vast majority of total well costs (both upfront and ongoing), reduction in D&C costs mean reductions in the price needed for a producer to “break even.”

Source: Bloomberg New Energy Finance

Economics: Cost of generating electricity in the US from natural gas vs. coal (\$/MWh)

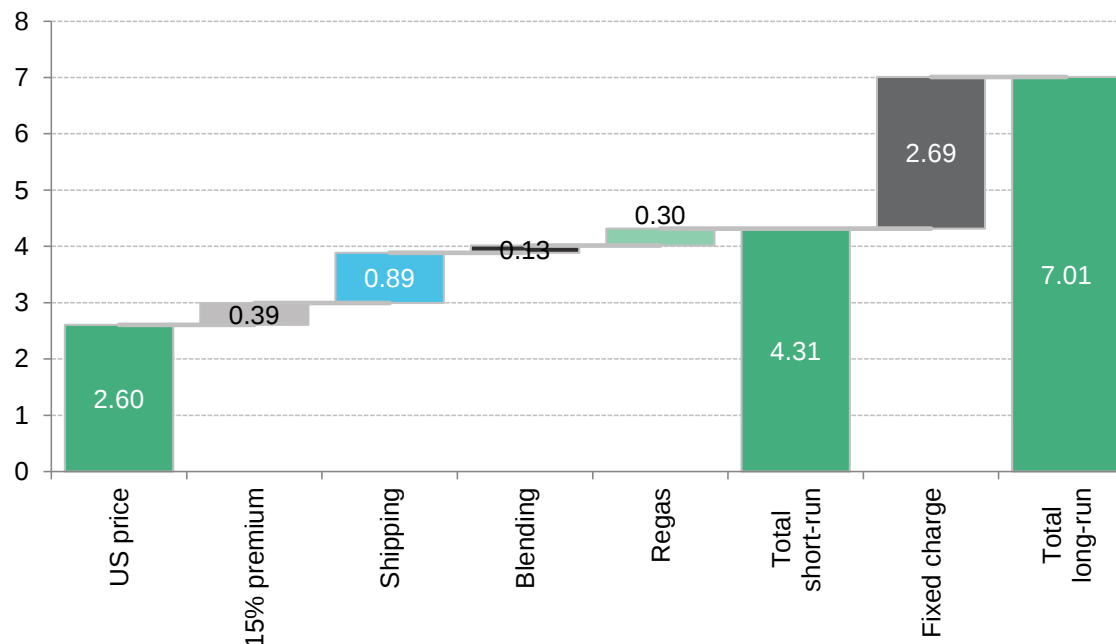


- Power has served as the swing demand source for natural gas: when the price of gas falls below the price of coal, gas burn rises until the differential (in \$/MWh) between the two fuels closes.
- As gas becomes consistently cheaper than coal, it creates a strong impetus for coal-to-gas switching.
- Power burn in PJM and the Southeast has the greatest sensitivity to gas prices. The coal-to-gas switch potential is, therefore, the strongest in these regions.

Source: Bloomberg New Energy Finance

Notes: Assumes heat rates of 7,410Btu/kWh for CCGT and 10,360Btu/kWh for coal (both are fleet-wide generation-weighted medians); variable O&M of \$3.15/MWh for CCGT and \$4.25/MWh for coal. Gas price used is Henry Hub. CCGT stands for a combined-cycle gas turbine. CAPP represents Appalachian coal prices.

Economics: LNG cost build, US Gulf Coast to Europe (\$/MMBtu)



- US LNG exports are expected to be priced competitively with current global LNG spot prices.
- US exports will be sold at a 15% premium from Henry Hub; this mark-up captures O&M costs. In addition, there is a fixed charge averaging about \$2.69/MMBtu to help terminal operators recuperate sunk costs.
- Five US LNG export terminals are currently under construction (Sabine, Cameron, Cove Point, Corpus Christi, Freeport), the first of which (Sabine Pass) is anticipated to commence service in Q1 2016.
- Together, these facilities could bring over 70MMtpa of LNG export capacity to the US by end-2019.

Source: Bloomberg New Energy Finance

Notes: 'Regas' is regasification, or the process in which imported LNG is expanded and reconverted into gas that can be injected into the pipeline distribution network. 'Fixed charge' is the cost associated with recouping upfront costs (the other costs shown here are short-run marginal costs).



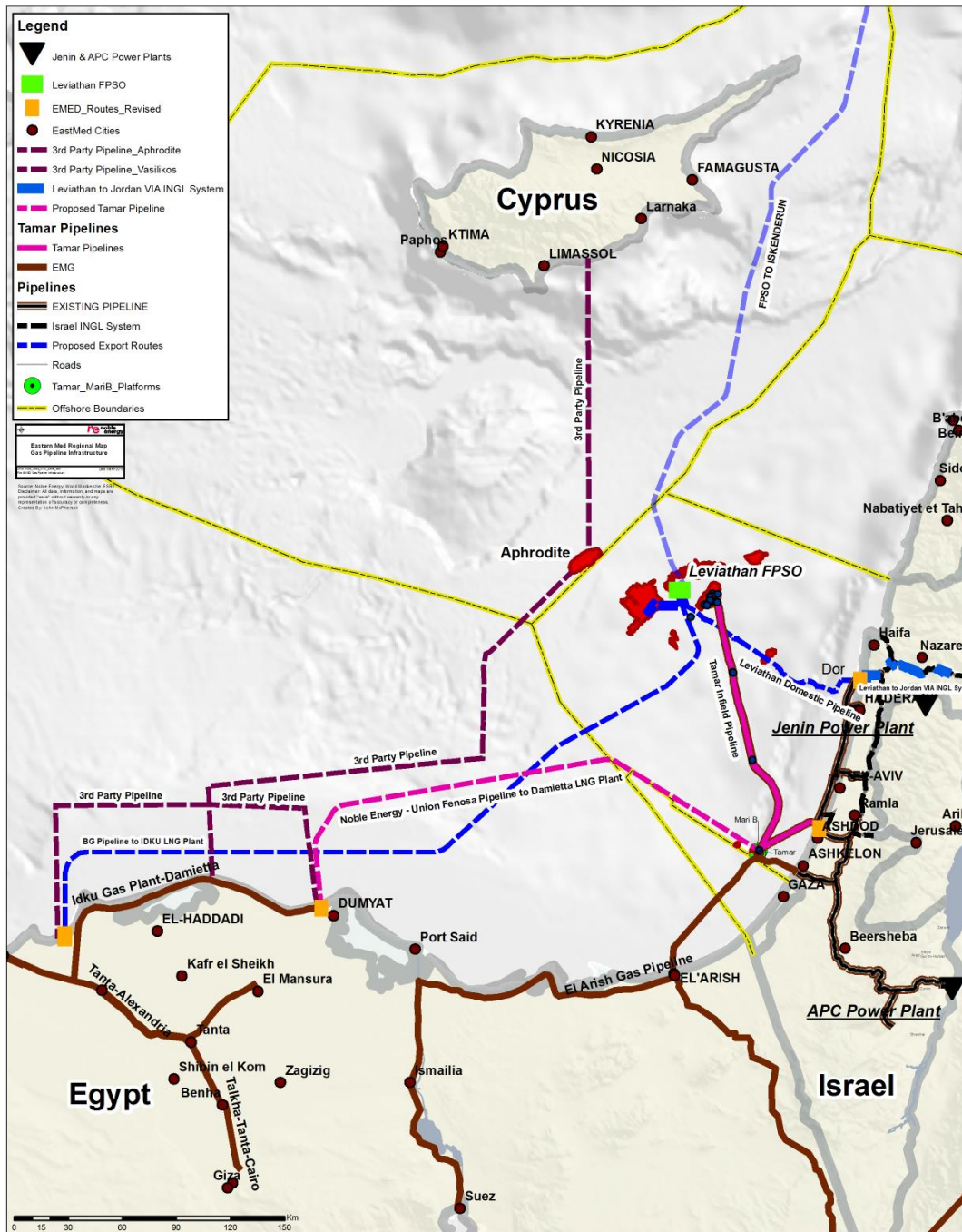


Figure 1: Israel's natural gas fields



Gas in the eastern Mediterranean



