NARUC Winter Policy Summit

Committee on Gas

The Evolution of Gas DSM and Energy Efficiency to Keep Up With a Changing World

Monday, February 10, 2020

Creating Low-Carbon, Low-Cost Energy Systems

Leveraging Gases and Infrastructure

Paula A. Gant, PhD
Senior Vice President, Strategy and Innovation

NARUC Winter Meeting
February 10, 2020

Technology and Solutions for Efficient, Affordable, Resilient and Low-Carbon Energy Systems

SUPPLY ▶ CONVERSION ▶ DELIVERY ▶ UTILIZATION

RESEARCH & DEVELOPMENT

PROGRAM MANAGEMENT

TECHNICAL/ ANALYTICAL

CONSULTING

TRAINING

COMMERCIALIZATION

400+ EMPLOYEES

World-class piloting facilities headquartered in Chicago area

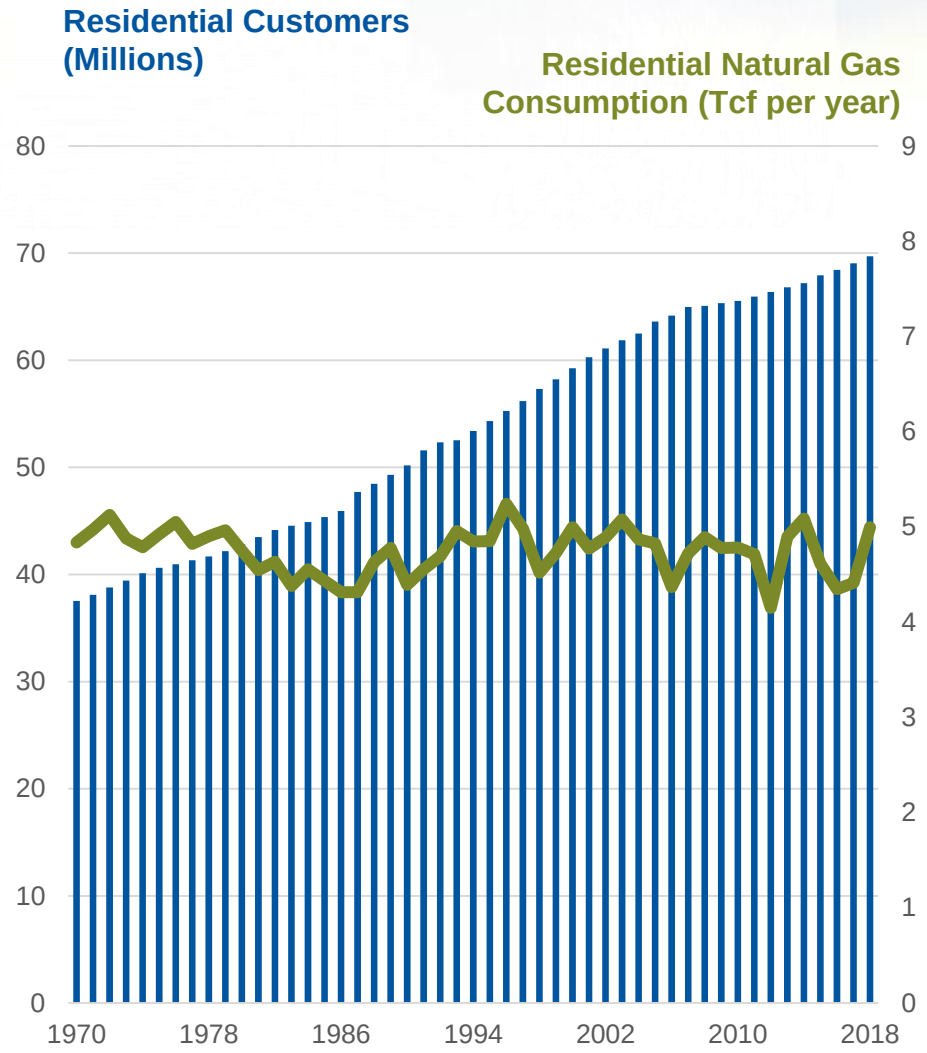
Natural Gas Systems: Proven, Efficient, Reliable, and Low Carbon

- Total LDC customers have grown by 86% since 1970 while total residential gas consumption is largely unchanged – resulting in per-customer emissions reduction of approximately 44% over the past 45 years

- *Where will be in 2040?*

  Further potential to improve efficiency and lower GHG impacts

  - Gas heat pumps
  - Improved building envelopes
  - Renewables Integration: biomethane, H_2, solar
  - Lower methane emissions



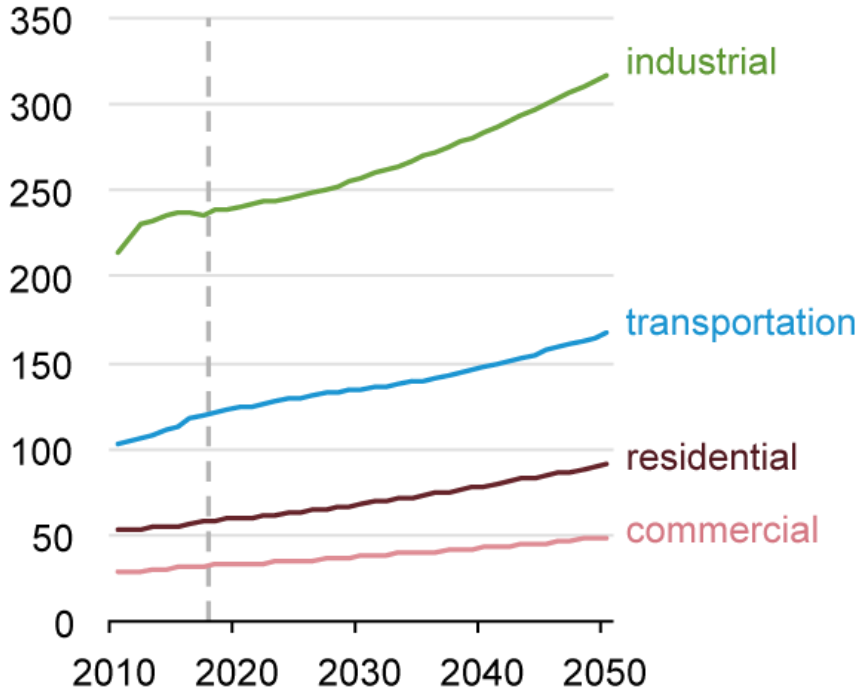
Source: DOE-EIA, EPA, AGA analysis

Economy-wide transformation required

Global Outlook: Robust, long-term demand for gases and fuels

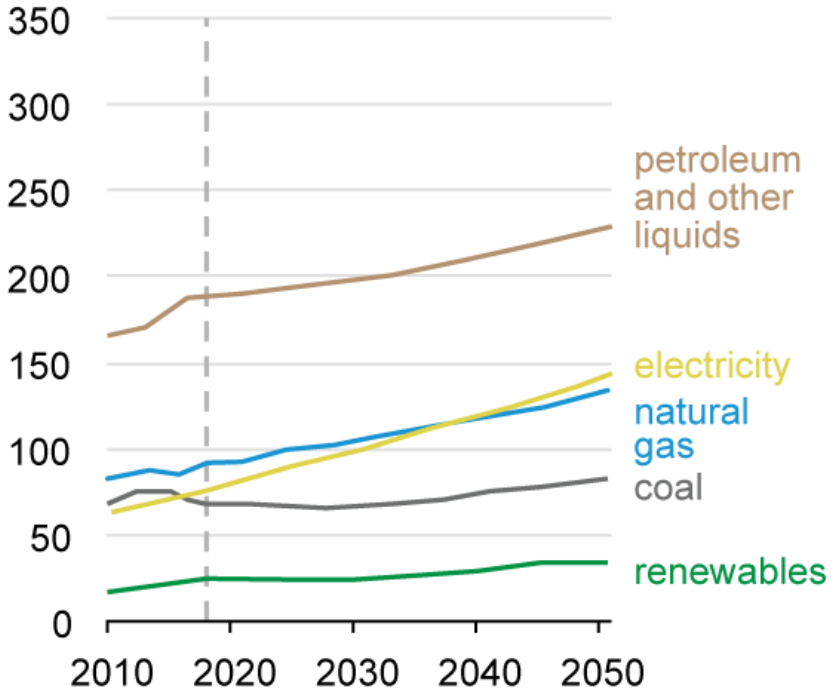
End-use energy consumption by sector, world

quadrillion British thermal units



End-use energy consumption by fuel, world

quadrillion British thermal units

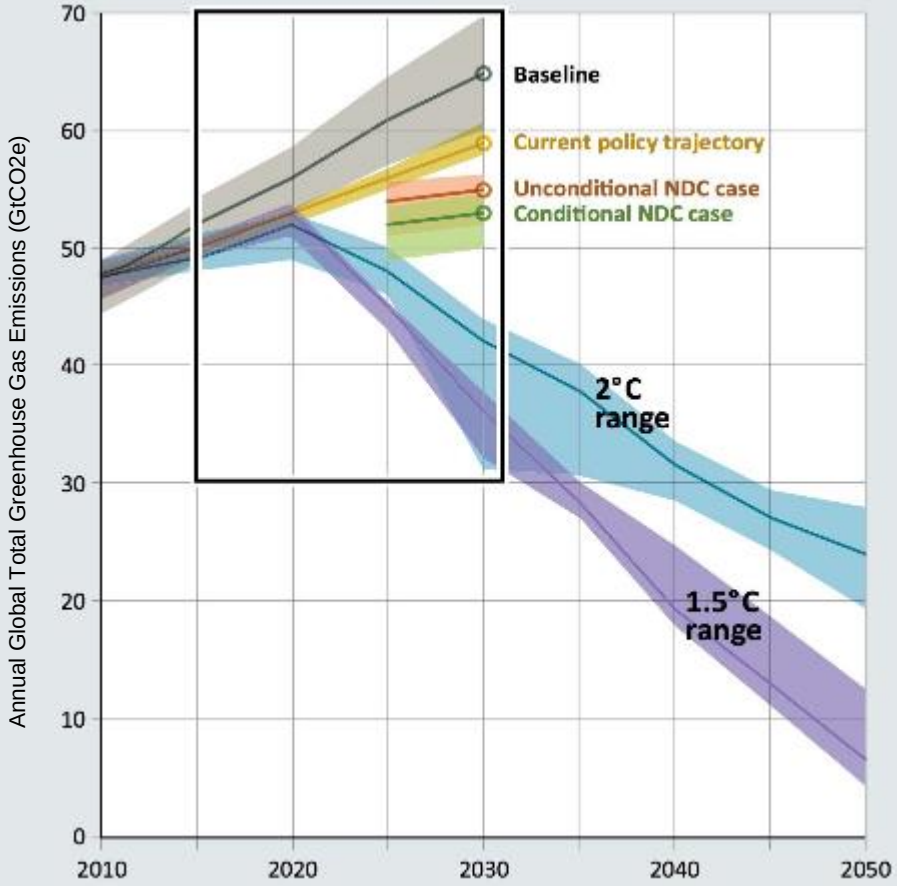


Source: U.S. Energy Information Administration

DUAL IMPERATIVES

Decarbonize Energy Systems

Global greenhouse gas emissions under different scenarios and the emissions gap in 2030



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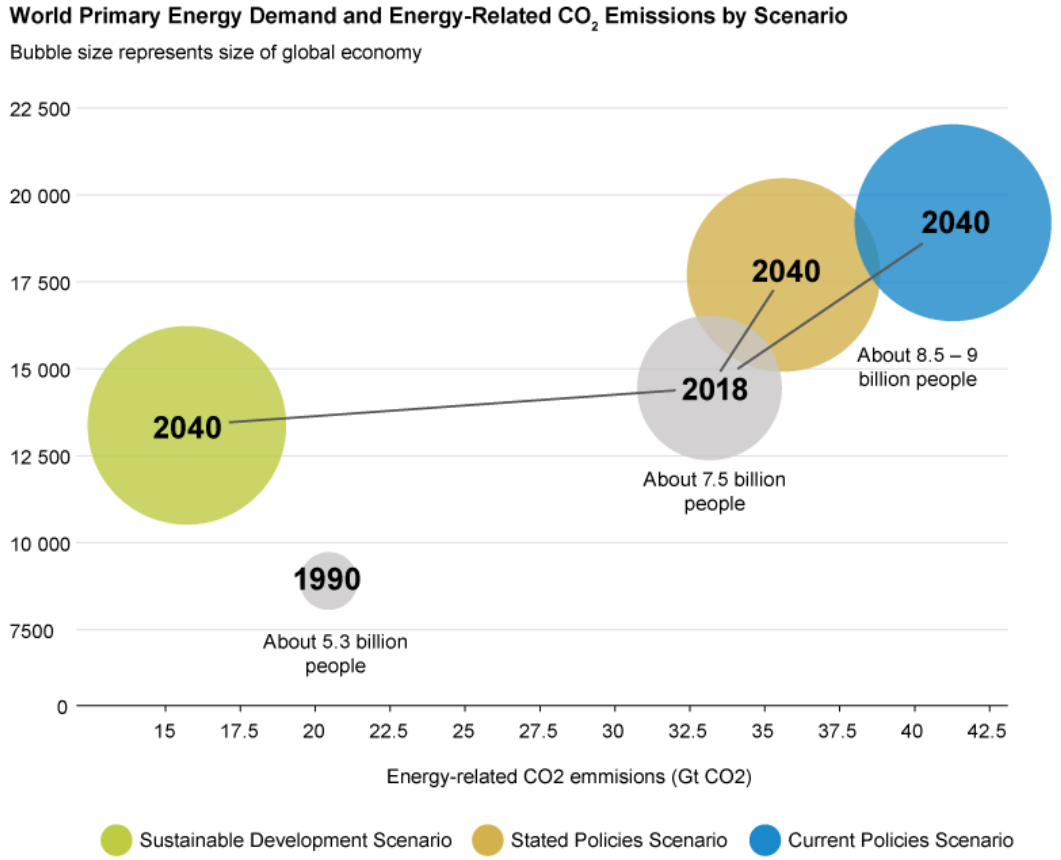
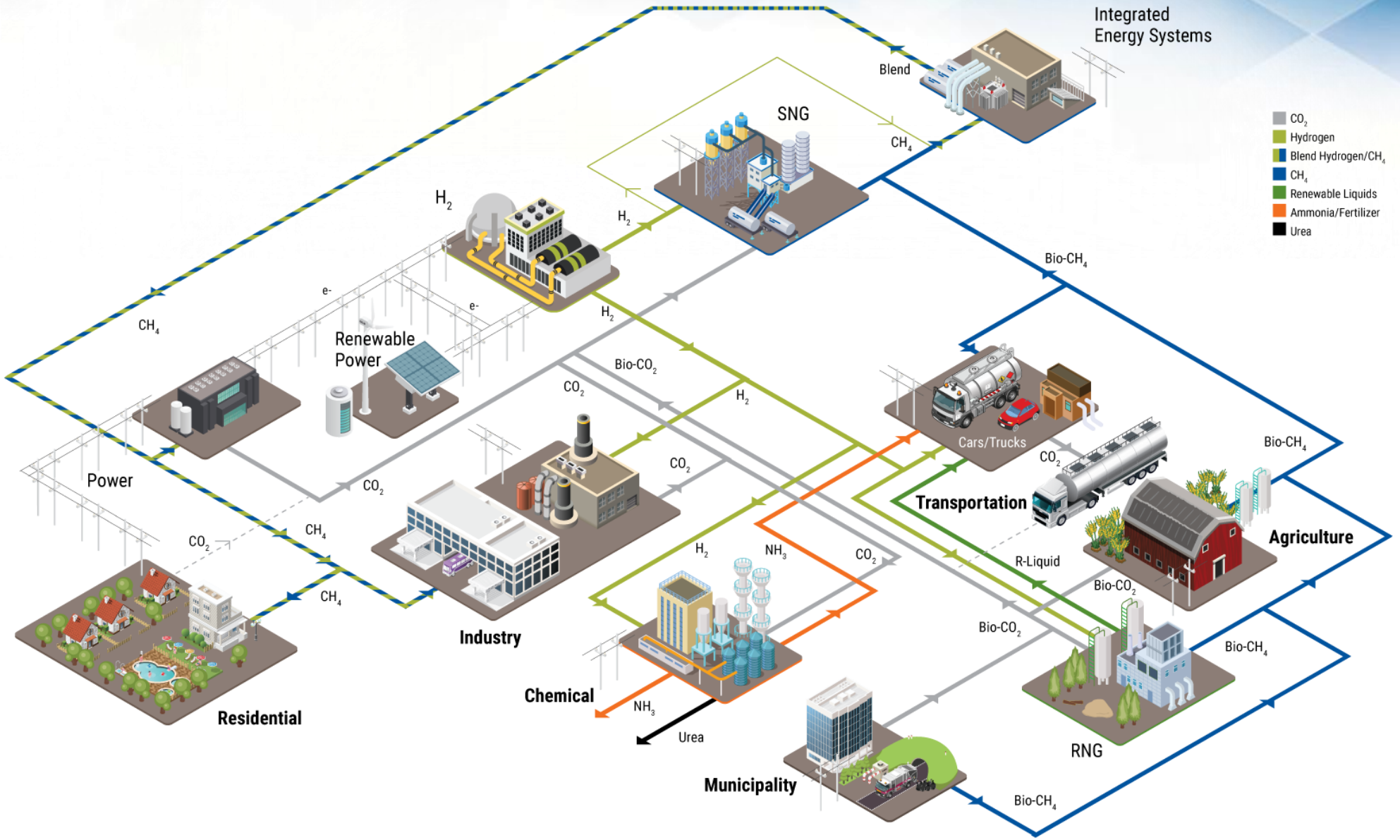
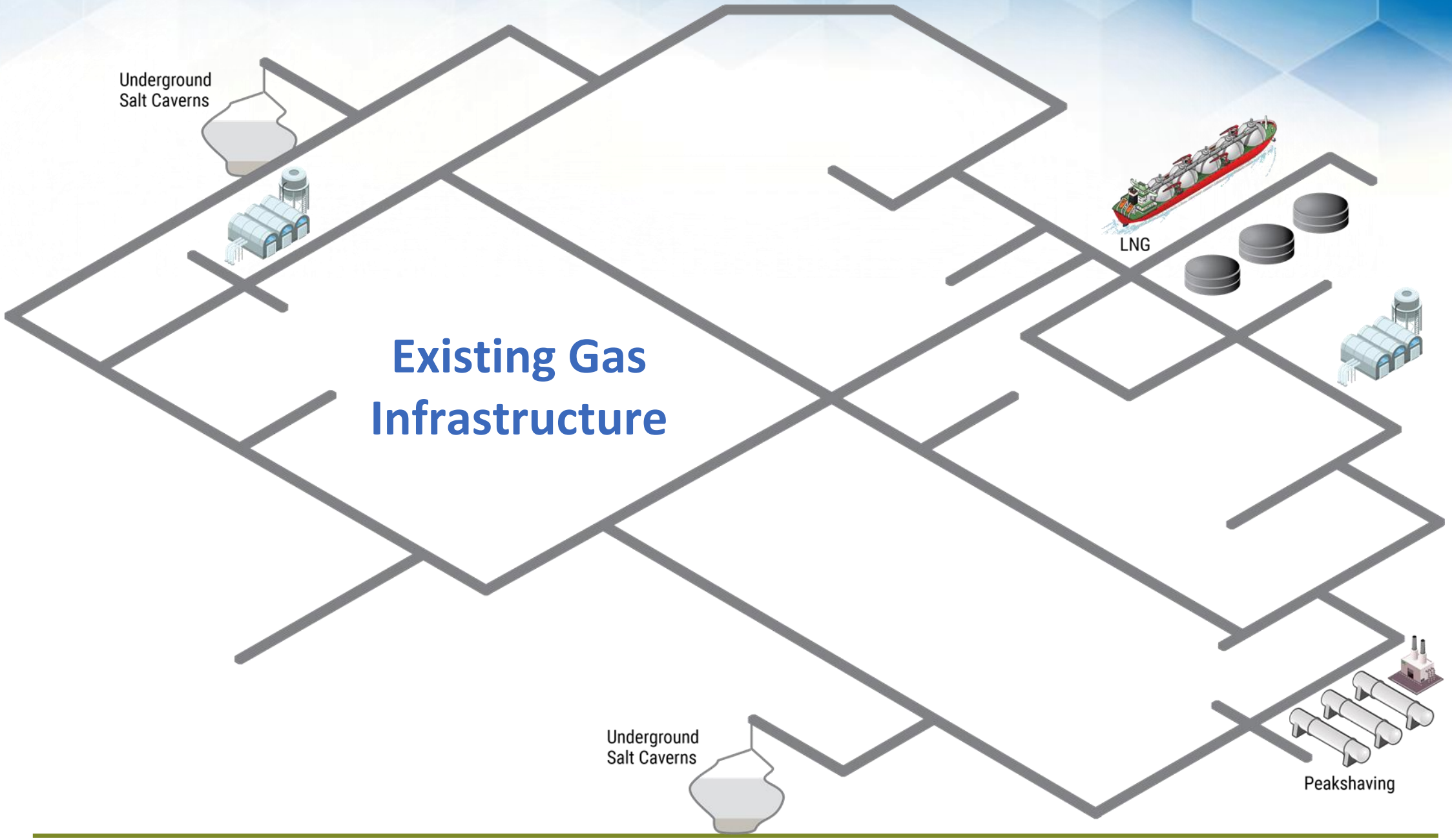
Provide Economies with the Energy Needed to Grow

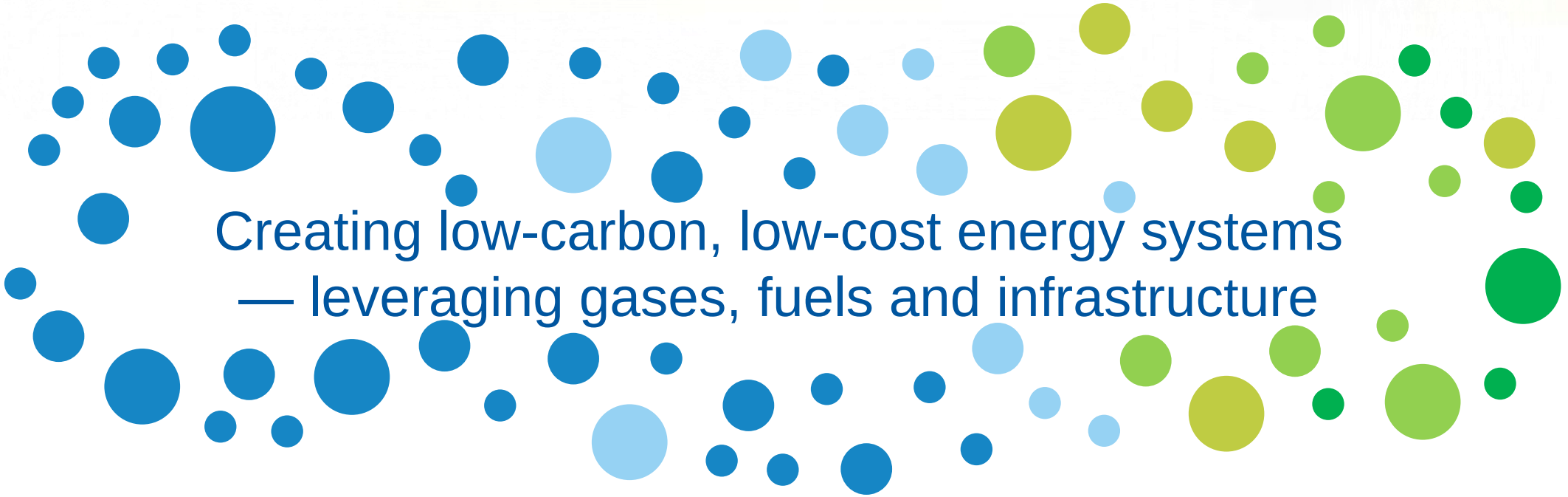


Sources: United Nations Environment Program (UNEP) 2017 Emissions Gap Report (left); International Energy Agency (right)


Integrated
Energy Systems
Blend
SNG
CH_4
H_2
CO_2
Hydrogen
Blend Hydrogen/CH_4
CH_4
Renewable Liquids
Ammonia/Fertilizer
Urea
Bio-CH_4
e-
e-
Renewable
Power
Power
Bio-CO_2
Cars/Trucks
Transportation
Agriculture
R-Liquid
Bio-CO_2
Industry
NH_3
Chemical
Urea
Residential
Municipality
RNG

Existing Gas Infrastructure





Creating low-carbon, low-cost energy systems — leveraging gases, fuels and infrastructure

www.gti.energy | **@gastechnology**

Energy Technologies Area Lawrence Berkeley National Laboratory

What Does It Cost to Save a Therm?

Presented by Greg Leventis

NARUC 2020 Winter Summit

This work was supported by the U.S. Department of Energy's Building Technologies Office.

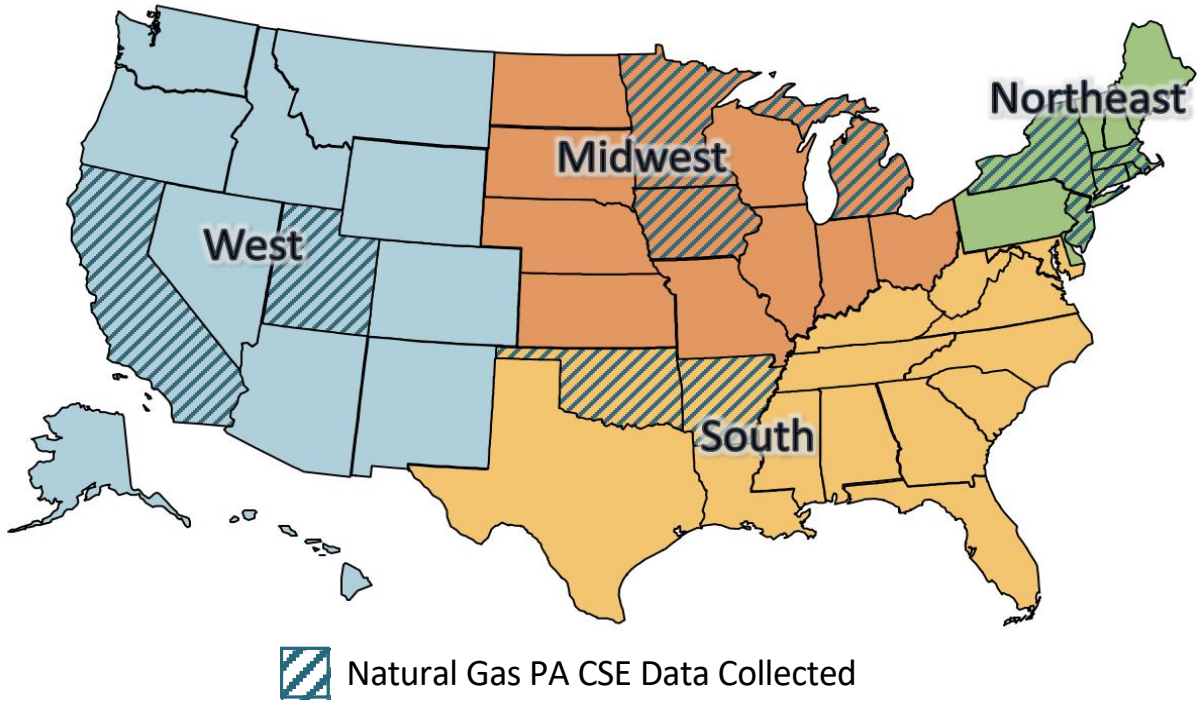
Berkeley Lab Studies on Cost of Saving Energy

- Program typology (2013)
- First study on program administrator (PA) cost of saving energy (2014)
  - Natural gas and electric investor-owned utilities (IOUs)
  - Program administrator (PA) cost – cost to utility or third-party administrator
  - Analysis at program level
- Updated analysis for electricity in 2015, including total cost
  - Total cost = PA cost + participant contributions
- Most recent electricity analyses for IOUs
  - 116 PAs in 41 states, 2009-2015 (2018)
  - Cost of saving peak demand, 9 states, 2014-2017 (2019)
- New analysis for publicly owned electric utilities (2019)
  - 111 PAs, representing 219 utilities in 14 states, 2012-17
  - Analysis at market-sector level
- New study on cost of saving gas — *report forthcoming*
  - By Steve Schiller, Ian Hoffman, Sean Murphy, Greg Leventis and Lisa Schwartz

https://emp.lbl.gov/projects/what-it-costs-save-energy

New Study on Cost of Saving Gas

- 37 PAs from 12 states: AR, CA, CT, IA, MA, MI, MN, NJ, NY, OK, RI and UT
  - Account for about 50% to 70% of annual national spending on natural gas efficiency programs
- Representation in all four census regions
- Portfolio and market sector-level spending and savings
- 2012-2017 study period



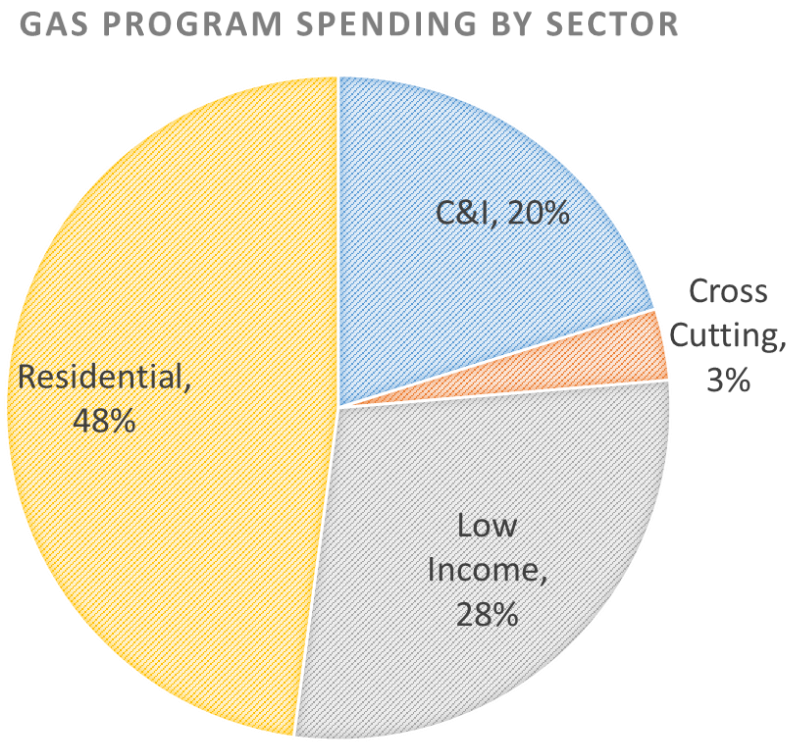
Scale of Efficiency Investments

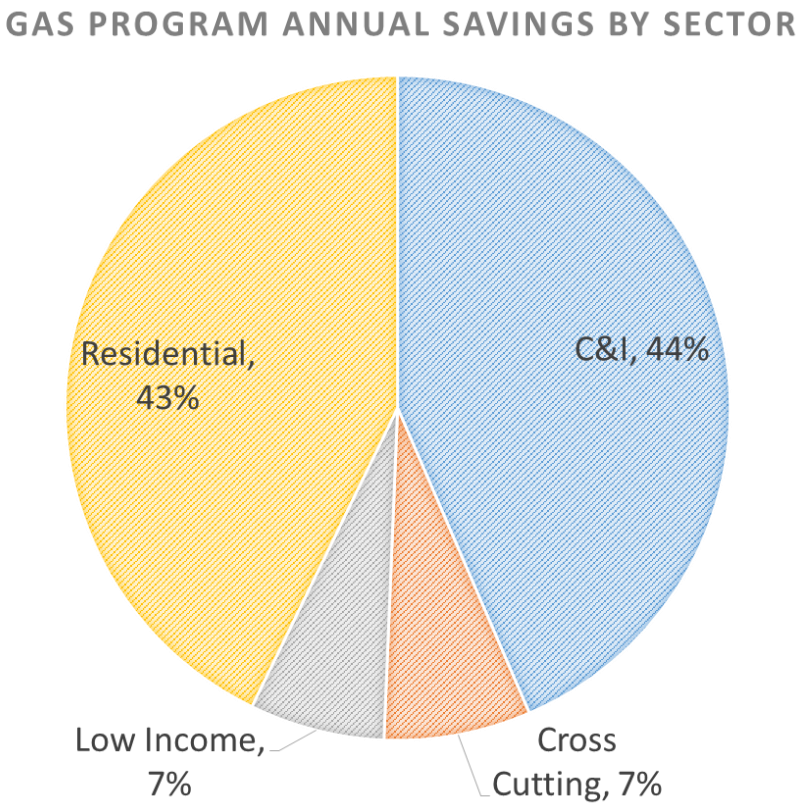
- About $5B invested, saving nearly 1.4B therms for our sample

Sector	Annual Gross Savings (millions of therms)	Spending ($2017 million)	Average PA CSE ($2017)	Median PA CSE ($2017)
Residential	587.3	$2,283.7	$0.43	$0.40
C&I	598.1	$989.6	$0.18	$0.24
Low Income	91.1	$1,350.1	$1.47	$1.16
Portfolio (All Sectors)	**1,375.0**	**$4,971.1**	**$0.40**	**$0.34**

Spending by Sector

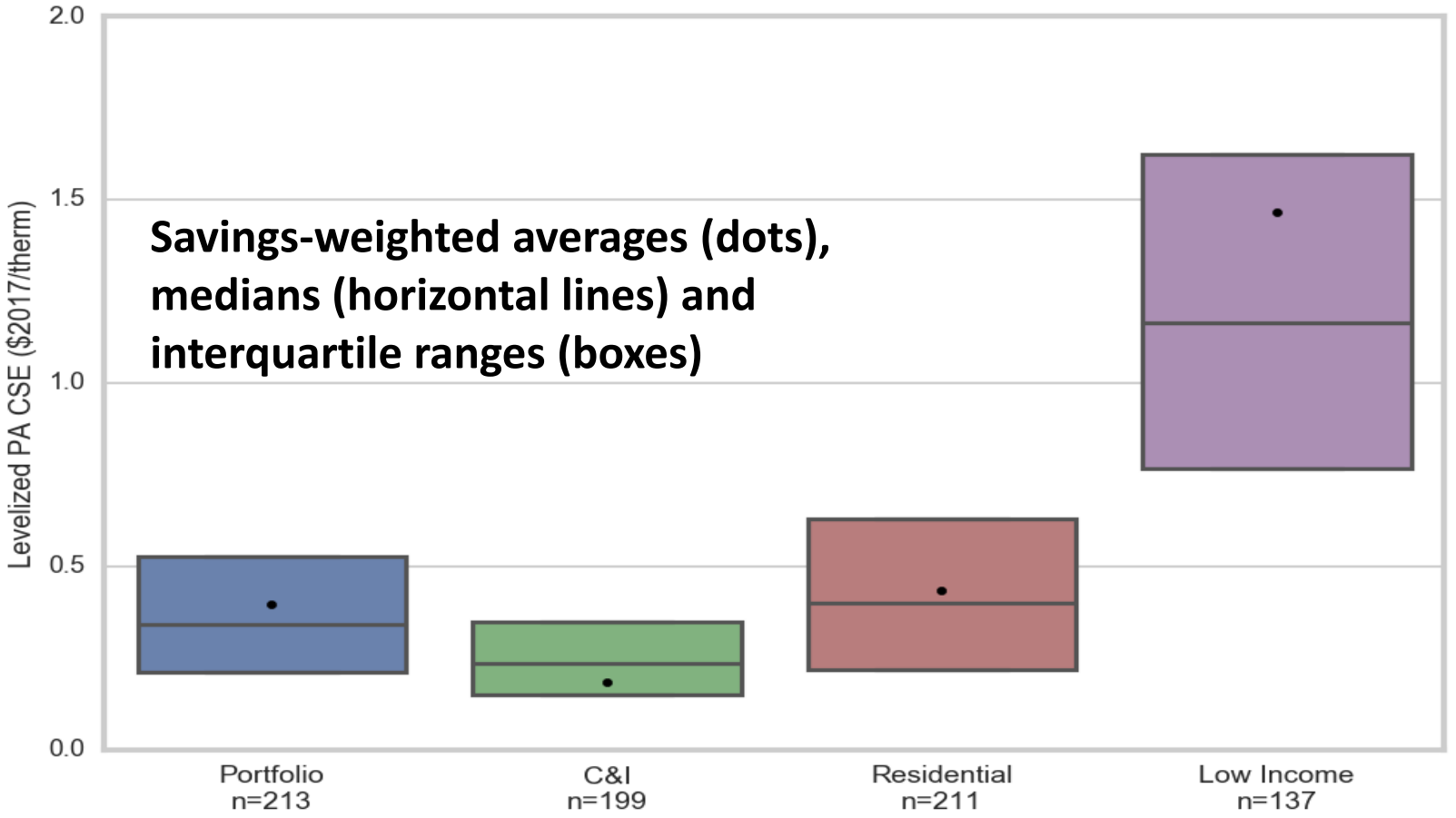
- Residential and low-income sectors account for 48% and 28% of spending in our sample, respectively
- Annual *savings* for residential and C&I are roughly equivalent





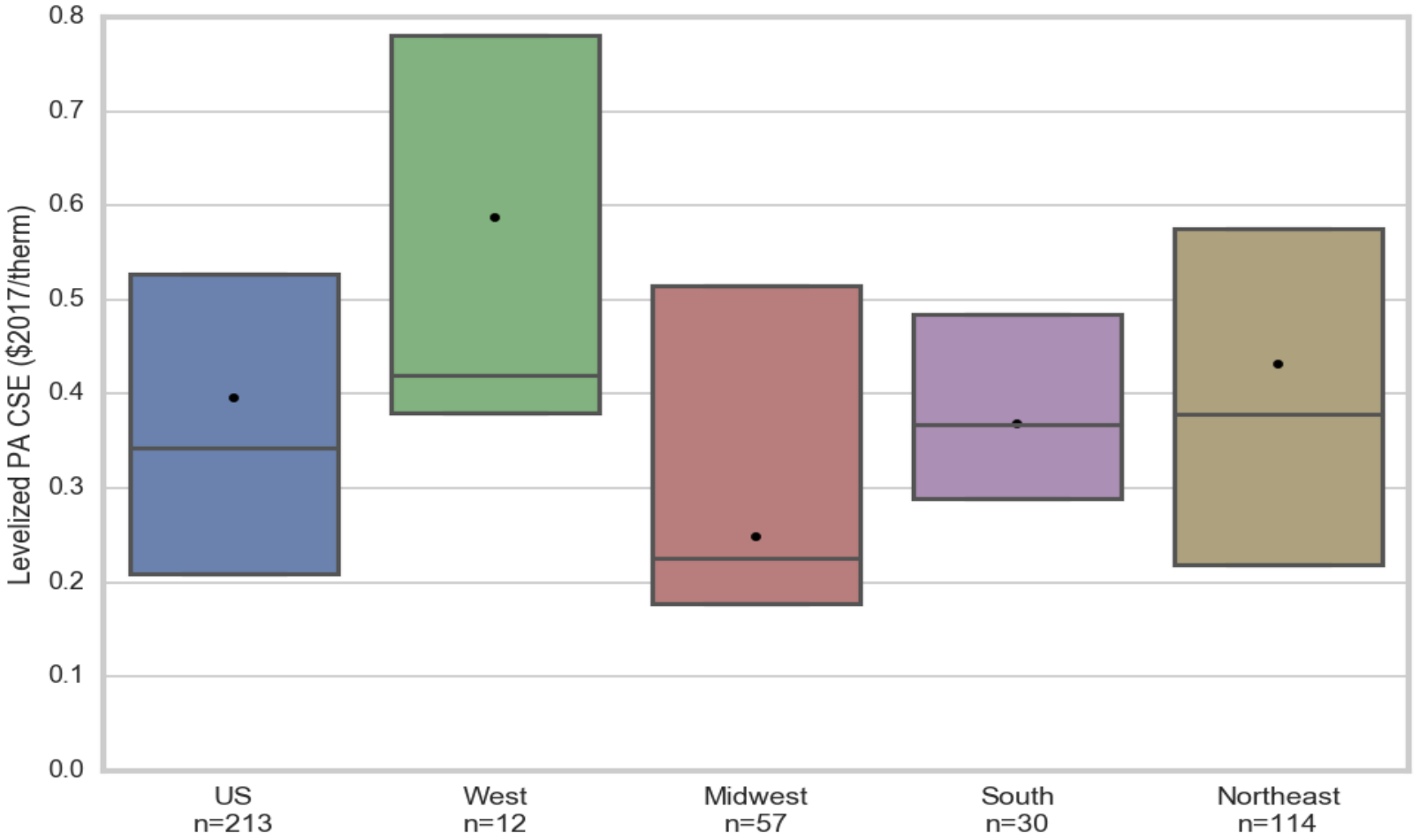
Cost by Market Sector

- Savings-weighted average PA cost of saving gas is $0.40/therm for our 12-state sample over the study period
- The cost of saving NG in a given jurisdiction can be compared to the avoided costs for that jurisdiction

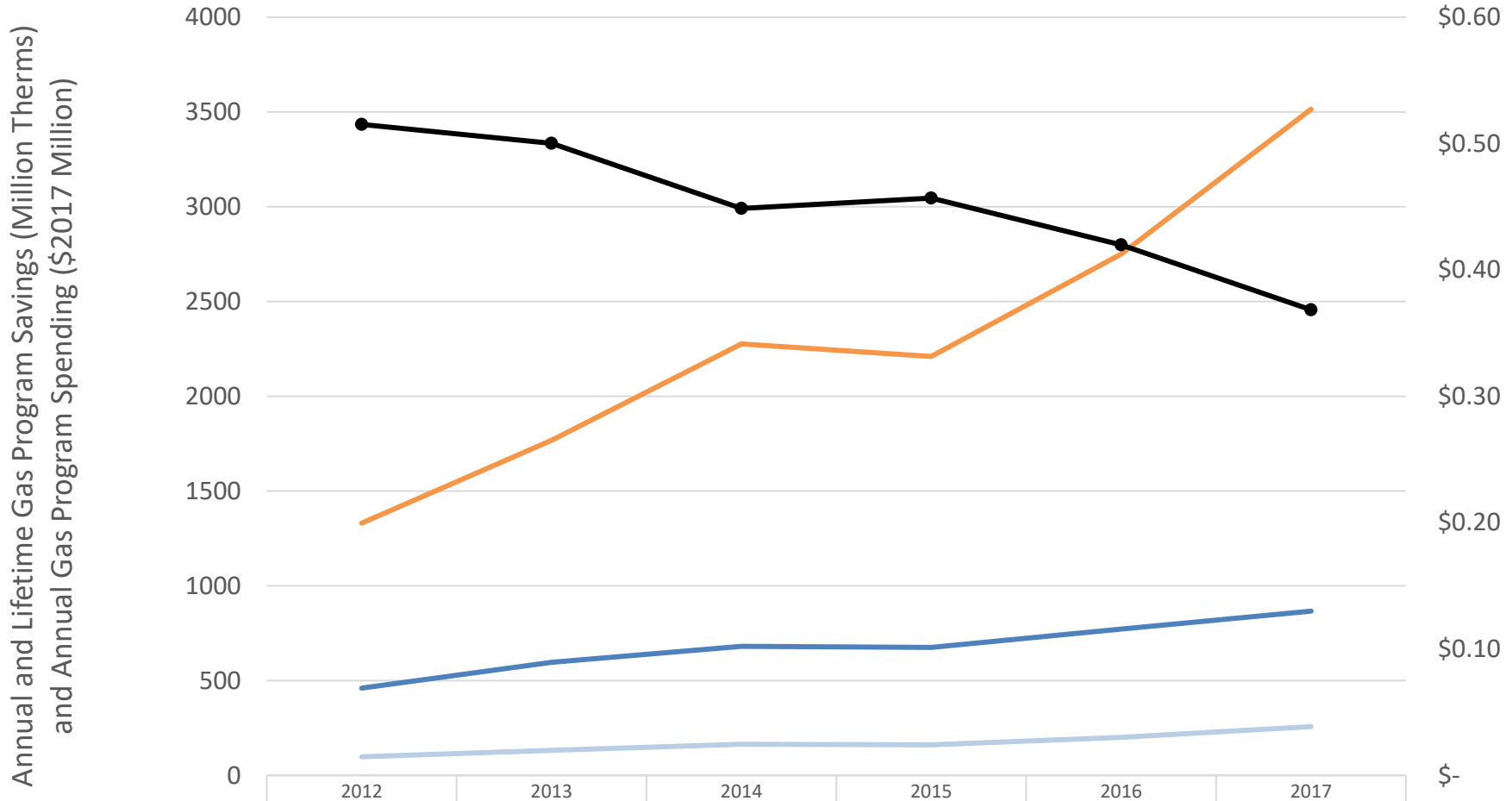


Costs by Region

- Cost/therm varies by region—Midwest $0.25 vs. West $0.59



Cost and Savings Trends



	2012	2013	2014	2015	2016	2017
Annual Savings (Million Therms)	98.6	132.7	164.4	161.4	200.7	257.4
Spending ($2017 Million)	$460.89	$597.08	$680.81	$675.58	$772.26	$867.11
Lifetime Savings (Million Therms)	1330.8	1767.5	2276.5	2209.8	2750.0	3514.6
Levelized PA CSE ($2017/therm)	$0.52	$0.50	$0.45	$0.46	$0.42	$0.37

Data and Reporting Challenges

- Data quality and screening challenges—for example, program administrator definition, estimation and reporting of:
  - Savings metrics
  - Program costs
  - Market sectors
  - Program types
  - Measure lives
- Reporting of gas program data has improved in many states. But significant and meaningful opportunities remain for great greater transparency, rigor and comprehensiveness in data reporting.
- Work could be expanded in various ways—for example, expand data collection, provide technical guidance on improved reporting, analyze drivers of cost trends, and estimate cost by program type.

For More Information

Electricity Markets and Policy Department
Lawrence Berkeley National Laboratory

Greg Leventis

gleventis@lbl.gov

Lisa Schwartz

lcschwartz@lbl.gov

https://emp.lbl.gov

Join Berkeley Lab's Electricity Markets and Policy Group mailing list (https://emp.lbl.gov/mailing-list) and stay up to date on our publications, webinars and other events. Follow the Electricity Markets & Policy Group on Twitter @BerkeleyLabEMP

Additional slides

Definition: PA Cost of Saving Gas

Levelized Program Administrator Cost of Saving Gas (PA CSE)	The cost to the *program administrator* for achieving gas savings over the economic lifetime of the actions taken, discounted back to when the costs were paid and the actions occurred

Assumptions and inputs:

- 6% discount rate (real)
- Estimated program average measure lifetimes
- Total program cost (not including participant contributions), including incentives (2017$)
- Gross annual therms saved

Program Administrator Cost of Saving Gas =

$$\frac{Capital\ Recovery\ Factor\ *\ (Program\ Administrator\ Costs)}{Annual\ Gas\ Savings\ (in\ therms)}$$

$$CRF = \frac{r(1+r)^N}{(1+r)^N - 1}.$$

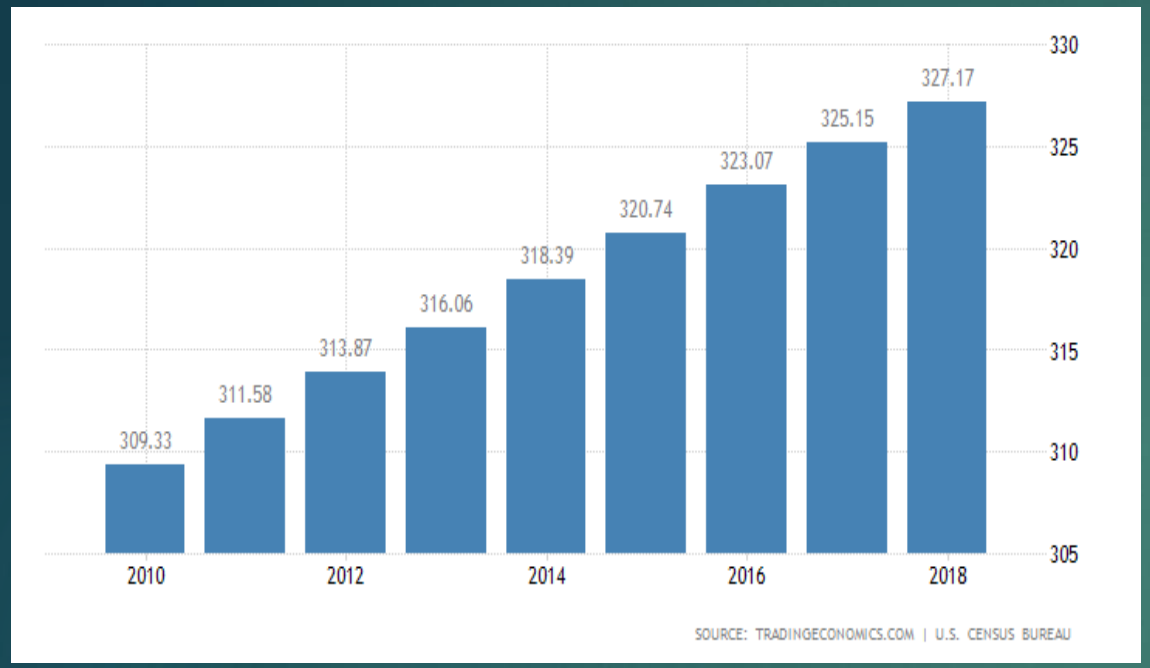
r = the discount rate

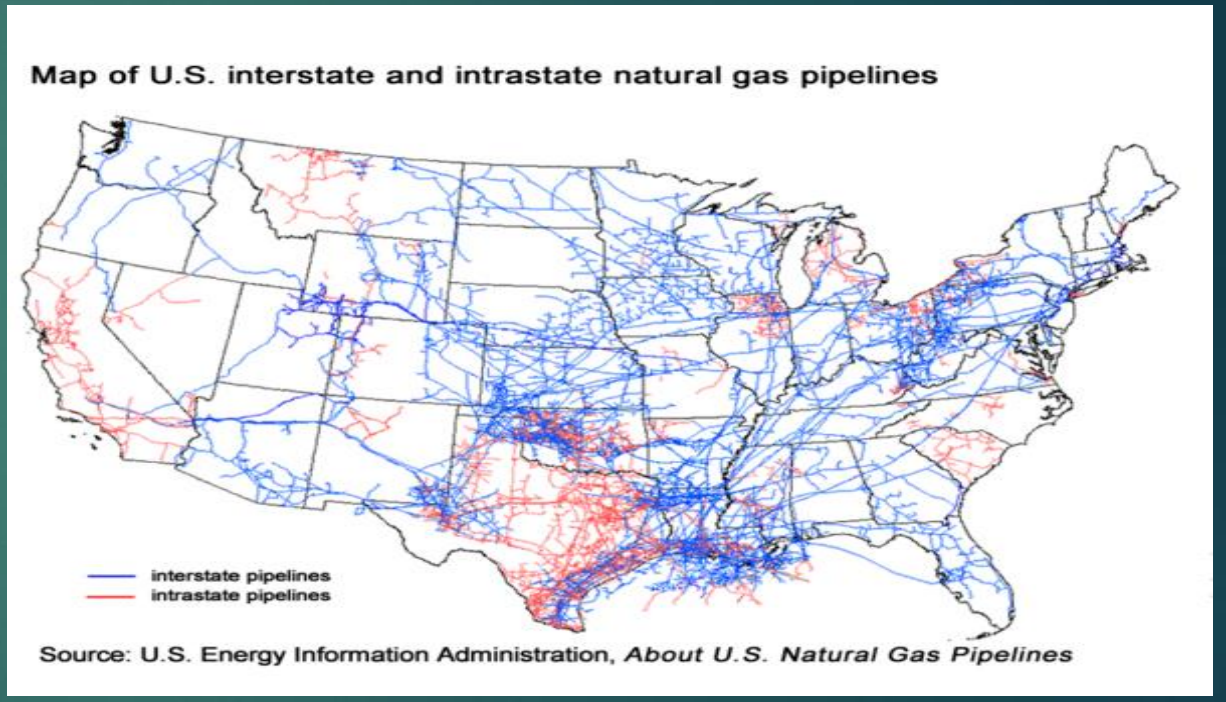
N = estimated program lifetime in years and calculated as the savings-weighted lifetime of measures or actions installed by participating customers in a program

Erick Ford

EXECUTIVE DIRECTOR, NJ ENERGY COALITION

Population Growth

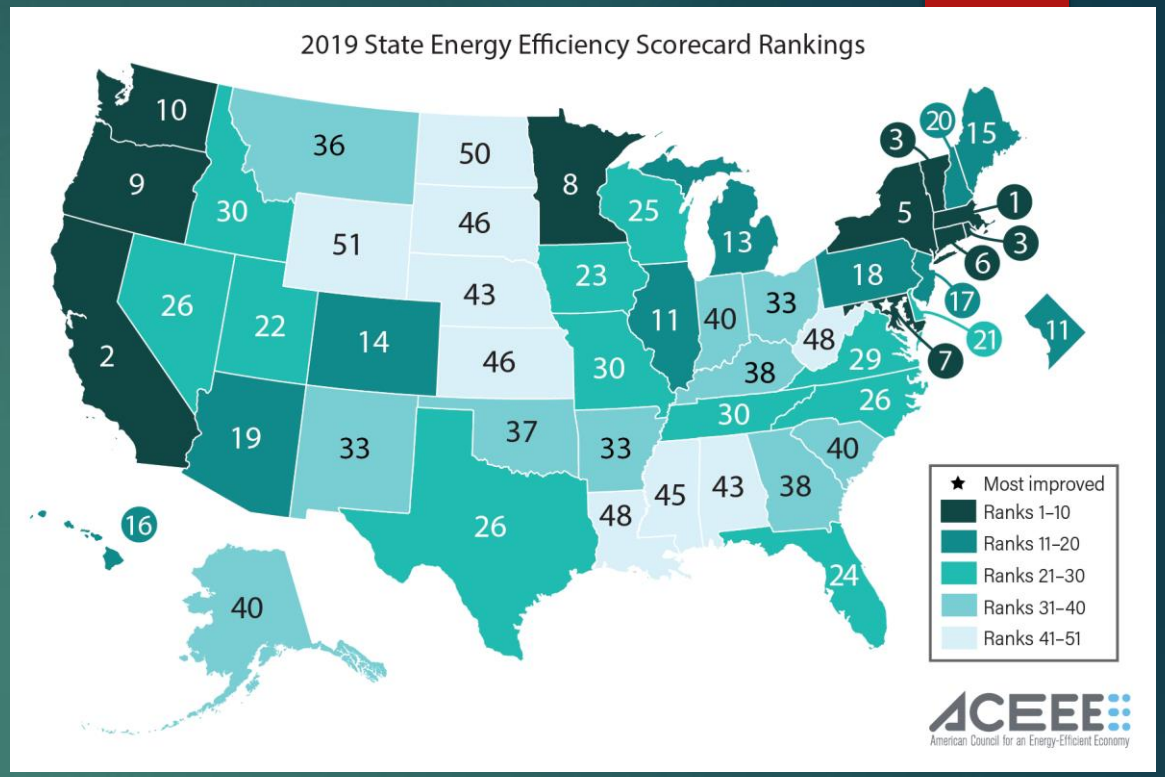




https://www.eia.gov/energyexplained/natural-gas/natural-gas-pipelines.php

- Superstorm Sandy
- Polar Vortex
- Expansion of Electrification
- Reliability and Security
- Technology

https://upload.wikimedia.org/wikipedia/commons/b/ba/Superstorm_Sandy_on_10-30-2012.png



https://www.aceee.org/press/2019/10/50-state-scorecard-reveals-states

Measurements and Verification

New York States - New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs Residential, Multi-Family, and Commercial/Industrial Measures

- http://www3.dps.ny.gov/W/PSCWeb.nsf/96f0fec0b45a3c6485257688006a701a/72c23decff52920a85257f1100671bdd/$FILE/TRM%20Version%206.1%20-%20January%202019.pdf

U.S. Environmental Protection Agency - June 2019Guidebook for Energy Efficiency Evaluation, Measurement, and Verification

- https://www.epa.gov/sites/production/files/2019-06/documents/guidebook_for_energy_efficiency_evaluation_measurement_verification.pdf

New Jersey – NJ Energy Master plan 2019 Energy Master Plan

- https://nj.gov/emp/docs/pdf/2020_NJBPU_EMP.pdf

Thank You

Natural Gas Energy Efficiency in Massachusetts

Robert Hayden, Commissioner
Massachusetts D.P.U.
robert.hayden@mass.gov

Outline of Presentation

- Gas Energy Efficiency in Massachusetts prior to 2010
- Passage of the 2008 Green Communities Act
- Creation of Energy Efficiency Advisory Council
- Three-Year Energy Efficiency Plans
- Savings, Spending, Benefits
- Impact on Ratepayers
- Future of Gas Energy Efficiency

IN THE BEGINNING OF TIME …

The DPU's Role Prior to 2008's Green Communities Act ("GCA"):

- DPU first required both gas and electric companies to pursue energy efficiency opportunities in the mid 1980s.
- Previously called Conservation & Load Management (C&LM) or Demand-Side Management/Market Transformation (DSM/MT)
- Massachusetts gas companies (LDCs) created a collaborative process called GasNetworks, which also included other New England LDCs.
- LDCs submitted 5 year DSM plans to the DPU, usually through a settlement process with low-income advocates and the MA Attorney General.
- Total expenditures for all LDCs was approx. $40 million in 2009.
- Total savings for all gas companies approx. 10 million (annual) therms in 2009.
- No statutory deadlines for Department approval of plans.
- LDCs submitted annual progress reports on spending, savings and benefits, but no formal review was done.

THEN IT WAS A BRAND NEW DAY …

DPU's Role under the GCA:

- Gas and electric companies ("Program Administrators" or "PAs") are required to jointly submit Three Year Plans to the DPU on or before October 31st of the applicable year.
- DPU has 90 days to review, modify and approve, or reject the plans in an adjudicatory proceeding.
- Required to make findings on:
  - all cost-effective energy efficiency;
  - program cost-effectiveness;
  - spending levels;
  - bill impacts.
- Program Administrators submit annual reports and a term report so DPU can review performance, and finalize cost recovery.

The GCA Created the Energy Efficiency Advisory Council

- GCA requires the Council to work collaboratively with Program Administrators to develop Three Year Plans, savings goals and budgets.
- The approval of plans and budgets requires a two-thirds majority vote of the Council.
- During the implementation period (i.e., Jan 2019 – December 2021), Program Administrators are required submit quarterly reports on savings, benefits and spending.
- Chaired by Massachusetts Department of Energy Resources.

Composition of the Council

The DPU appoints the voting members representing the following interest groups:

- Residential consumers;
- Low-income Weatherization & Fuel Assistance Program;
- Environmental community;
- Businesses, including large C&I;
- Manufacturing industry;
- Energy efficiency experts;
- Organized labor;
- MA Department of Environmental Protection;
- MA Attorney General;
- MA Executive Office of Housing and Econ Development;
- Non-profit Network;
- A Massachusetts city or town;
- Mass. Association of Realtors;
- Business employing fewer than ten persons that performs energy efficiency services;
- Non-voting members: each Program Administrator; heating/oil industry; ISO New England Inc.; and energy efficiency businesses.

Requirements of the GCA

The DPU must ensure that:

- Three-Year Plans must provide for the acquisition of all available energy efficiency resources that are cost effective or less expensive than supply.
- A Program Administrator has demonstrated that it will meet its resource needs first through cost-effective energy efficiency and demand reduction resources in order to mitigate capacity and energy costs for all customers.
- The Three-Year Plans must provide for the acquisition of these resources with the lowest reasonable customer contribution.
- Administrative costs have been minimized to the fullest extent practicable;
- Competitive procurement has been used to the fullest extent practicable;
- The low-income sector is to be allocated at least 20 percent of gas energy efficiency funds.
- It considers the effect of any rate increases on consumers when approving the use of customer funds for energy efficiency.

Energy Efficiency Measures installed

For residential and C&I:

- Boilers
- Furnaces
- Water Heaters
- Tankless Water Heaters
- Thermostats –WIFI
- Thermostats - Programmable
- Air Sealing
- Insulation
- Shower Heads
- Faucet Aerators
- HVAC
- Lighting (LED)
- Boiler Reset Controls

For only C&I:

- Refrigerators
- Ovens/Fryers
- Spray Valves
- Steam Traps

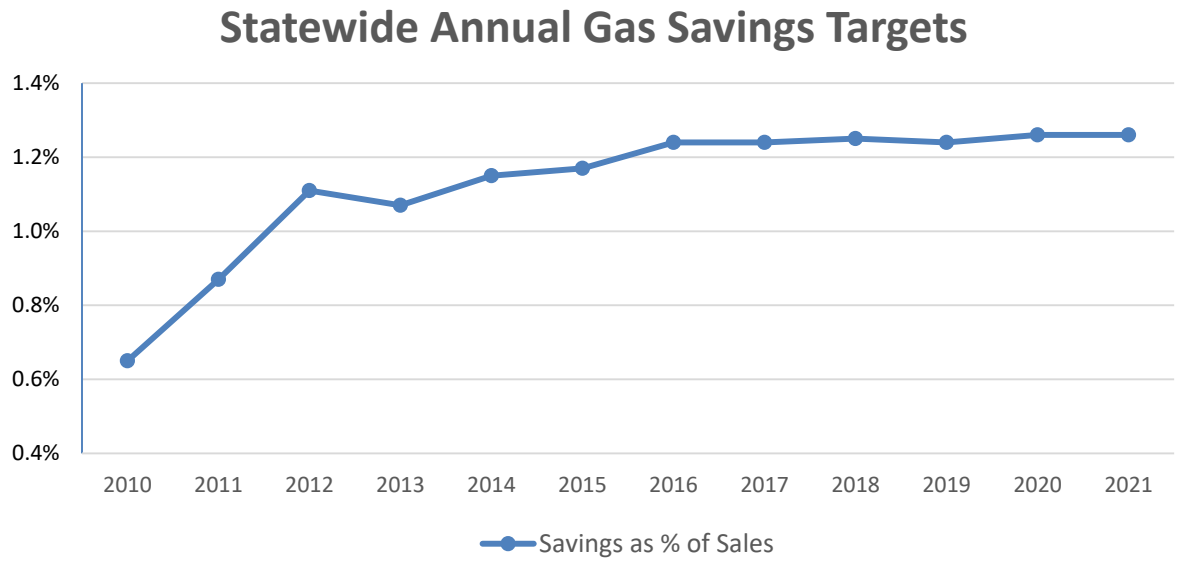
For only Residential:

- Behavior

For only Low-Income:

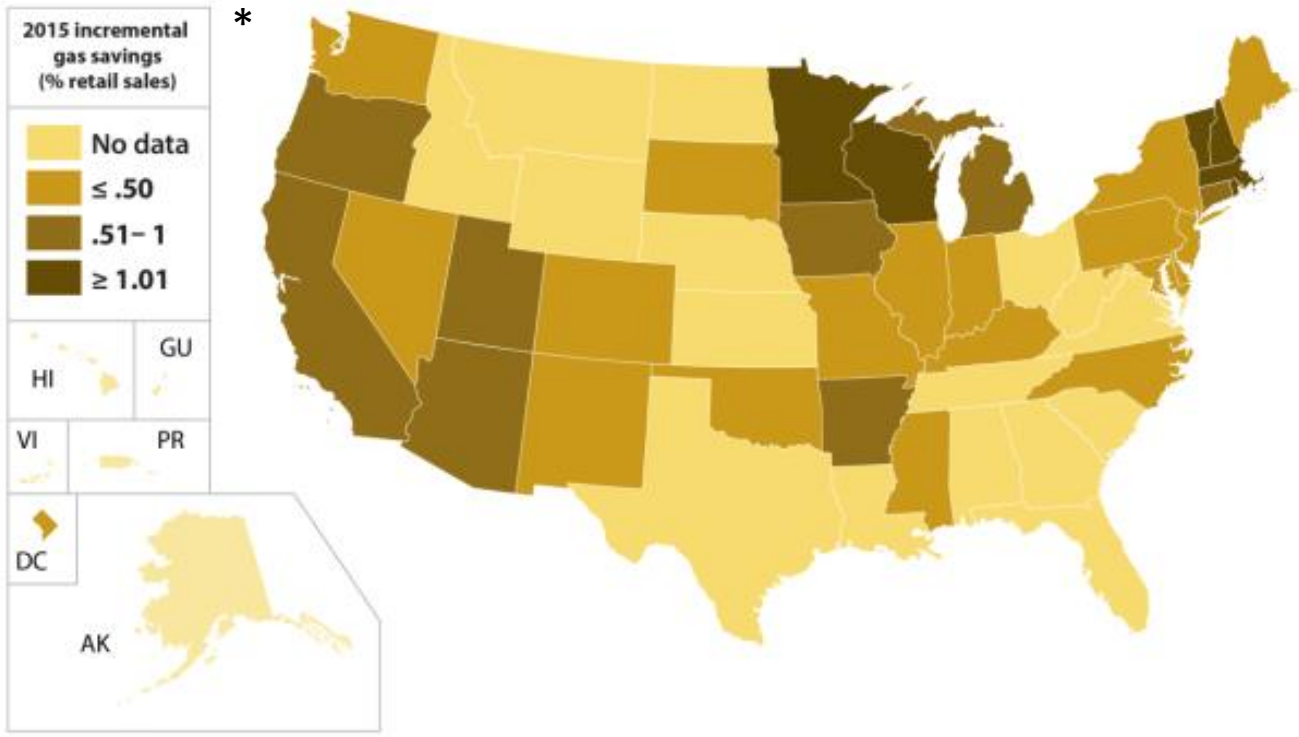
- Whole House Offerings

Energy Efficiency Savings Goals



- The Council and PAs collaborate on a savings goal which is represented as a percentage of retail gas sales.
- Savings goal is used as the basis for what it means to achieve "all cost-effective energy efficiency".
- As each gas company creates its plan, it tries to achieve this level of savings annually.
- Bigger gas companies plan to meet a higher goal, while smaller companies usually have a lower goal.
- In 2010, the statewide savings target was 0.65% of total gas sales.
- In 2019, the statewide savings target was 1.25% of total gas sales.

Comparison to other States

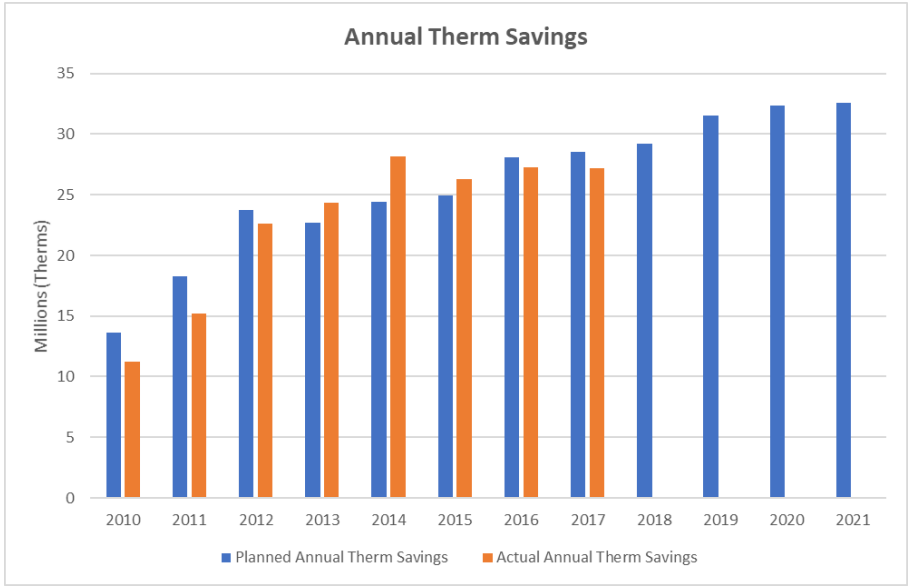


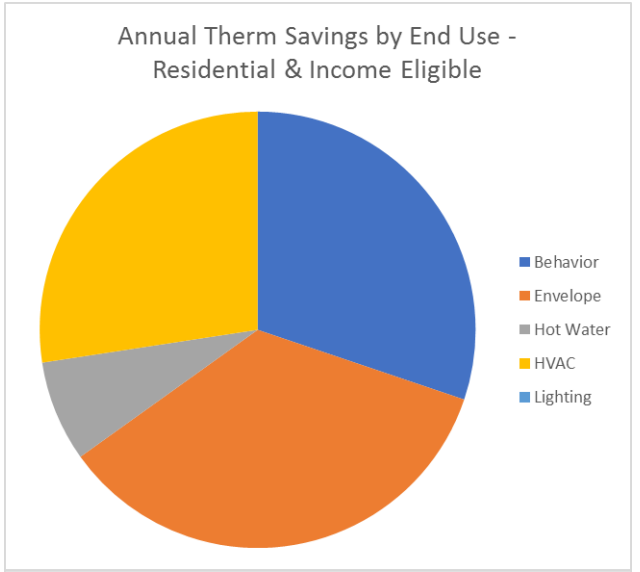
*

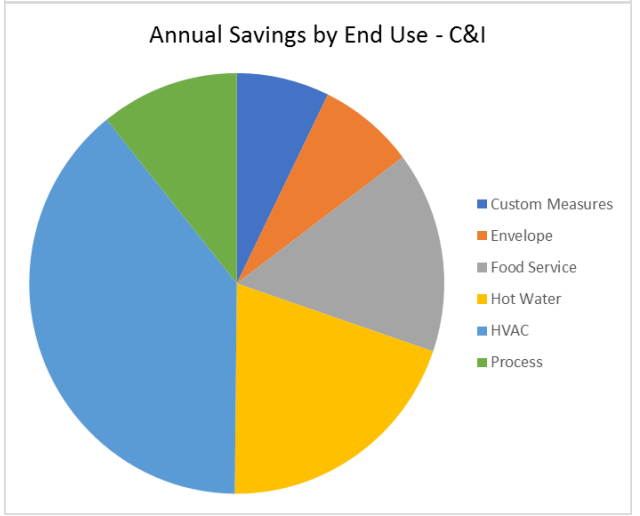
- Many states do not offer gas energy efficiency programs
- Of the ones that do, only a few have achieved savings over 1% of retail gas sales.
- The 2019-2021 statewide target of 1.25% of retail sales for Massachusetts is the highest nationally.

* Nadel, S. 2017. *Natural Gas Energy Efficiency: Progress and Opportunities*. Washington, DC: ACEEE. https://www.aceee.org/sites/default/files/publications/researchreports/u1708.pdf.

Energy Savings: annual

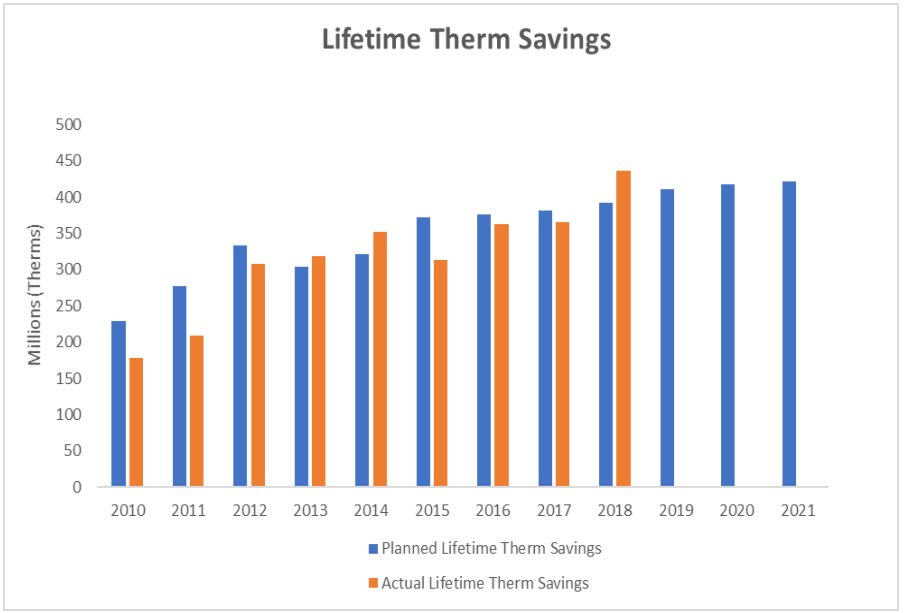


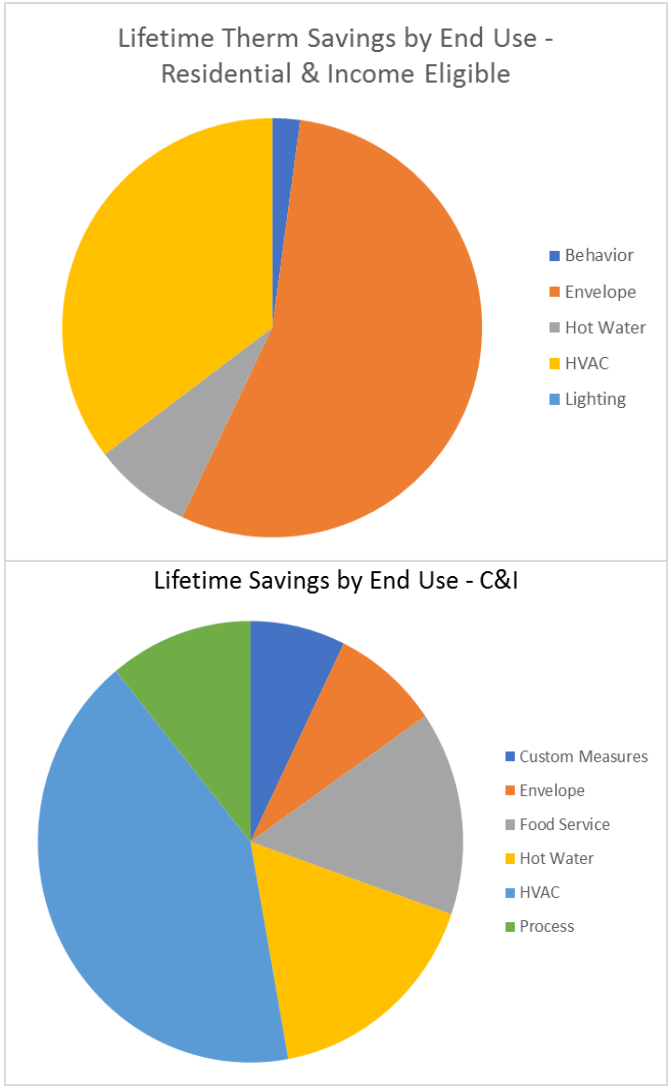




- 11 million annual therms were saved in 2010 due to gas energy efficiency.
- Gas companies plan to save 32 million therms in 2021.
- Focused mostly on HVAC and envelope (insulation & air/duct sealing) end uses.
- Behavior programs have a measure life of one year. Big impact on annual savings.

Energy Savings: Lifetime



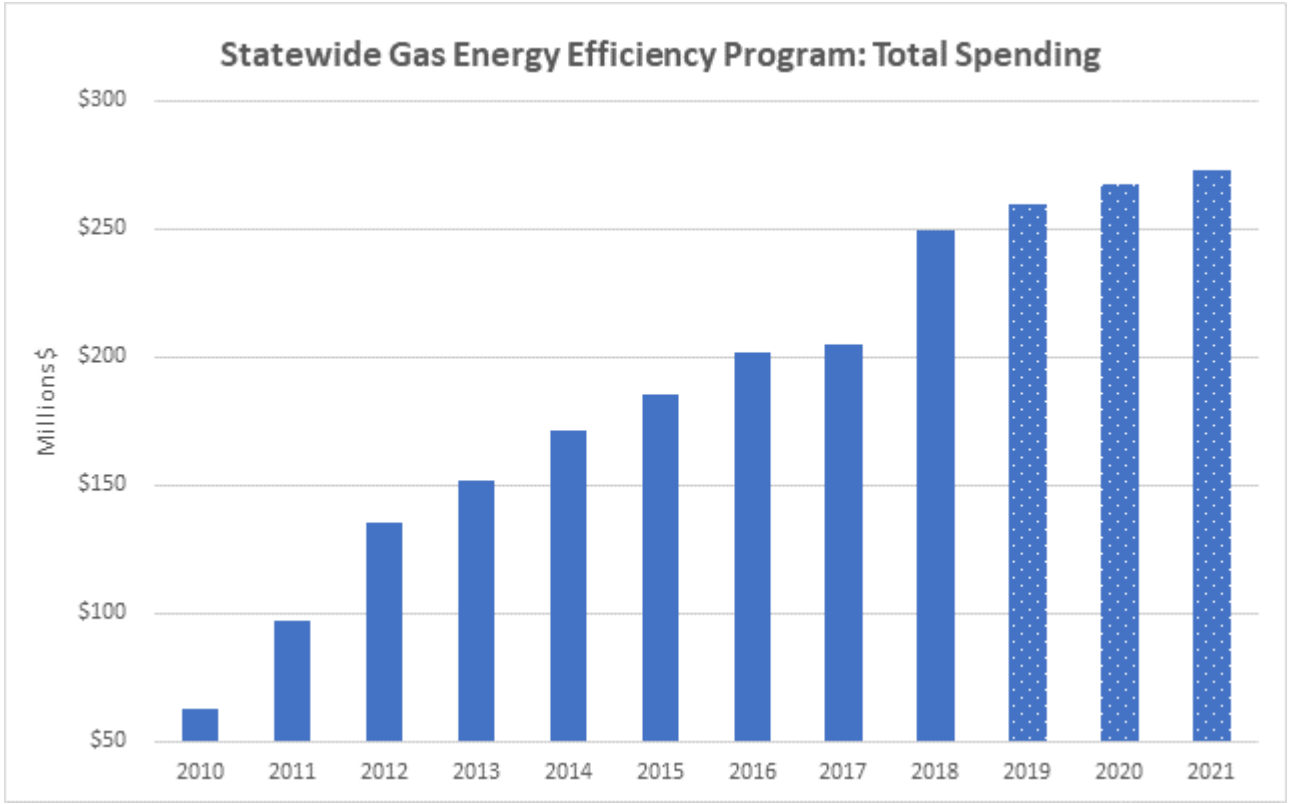


- Lifetime therm savings take into account the long lives of gas measures, including furnaces, boilers and insulation.
- The average lives of gas heating measures are between 15 and 25 years.
- In 2019-2021, gas companies project to save 400 million lifetime therms.

Cost Effectiveness

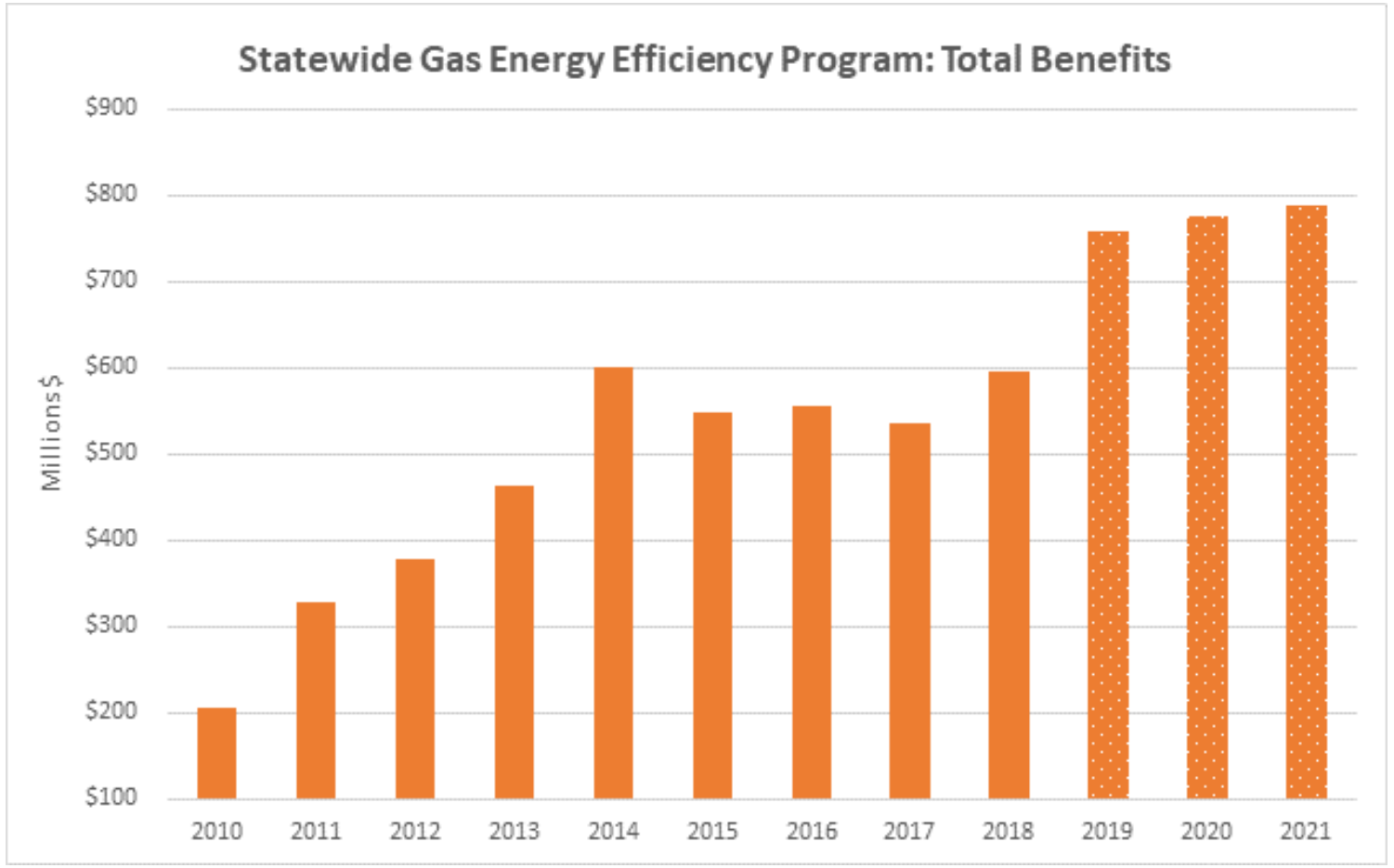
- The Department uses the Total Resource Cost ("TRC") test to determine whether programs are cost-effective with a benefit-cost ratio ("BCR") of at least 1.0;
- The TRC includes all benefits and costs associated with the energy system, as well as all benefits and costs associated with program participants;
- In its latest Three Year Plan decision, the DPU determined that the avoided cost of complying with climate policies can be included in the calculation of cost effectiveness.
- Total Benefits = gas benefits + non-gas benefits + Water benefits + non-energy impacts + avoided cost of climate policies.

BUDGETS



For 2010, the statewide gas energy efficiency budget was $77 million.
For 2021, the statewide gas budget is projected to be over $272 million.

BENEFITS



Total benefits for 2010 were over $200 million.
Total benefits projected for 2021 is over $788 million.

Rate and Bill Impacts

- Gas energy efficiency is funded entirely through an annual surcharge ("EES"), on a gas customer's bill;
- The EES allows Program Administrators to recover their energy efficiency budgets for the upcoming program year.
- While energy efficiency programs generally result in increases in rates, investments in energy efficiency programs also result in savings on a participant's entire bill because of the reduced energy usage.
- Bill savings for residential customers who participate are anywhere from 2-30% depending on the measures installed.
- For a monthly bill of $185 for a typical residential heating customer in the winter (using 125 therms), the EES is about 10% of the total bill.

What's next for Gas Energy Efficiency?

Gas companies will:

- Review potential of gas demand response and address feasibility in the next Three-Year Plan for 2022-2024;
  - A demand response demonstration project is currently under review as part of a performance based ratemaking ("PBR") proposal in a distribution rate proceeding pending before the DPU;
- Review temperature optimization and its effect on winter demand;
- EM&V study to properly value winter benefits
  - Results due in 2020;
- Continue to examine new technologies and their potential.