January 21, 2016

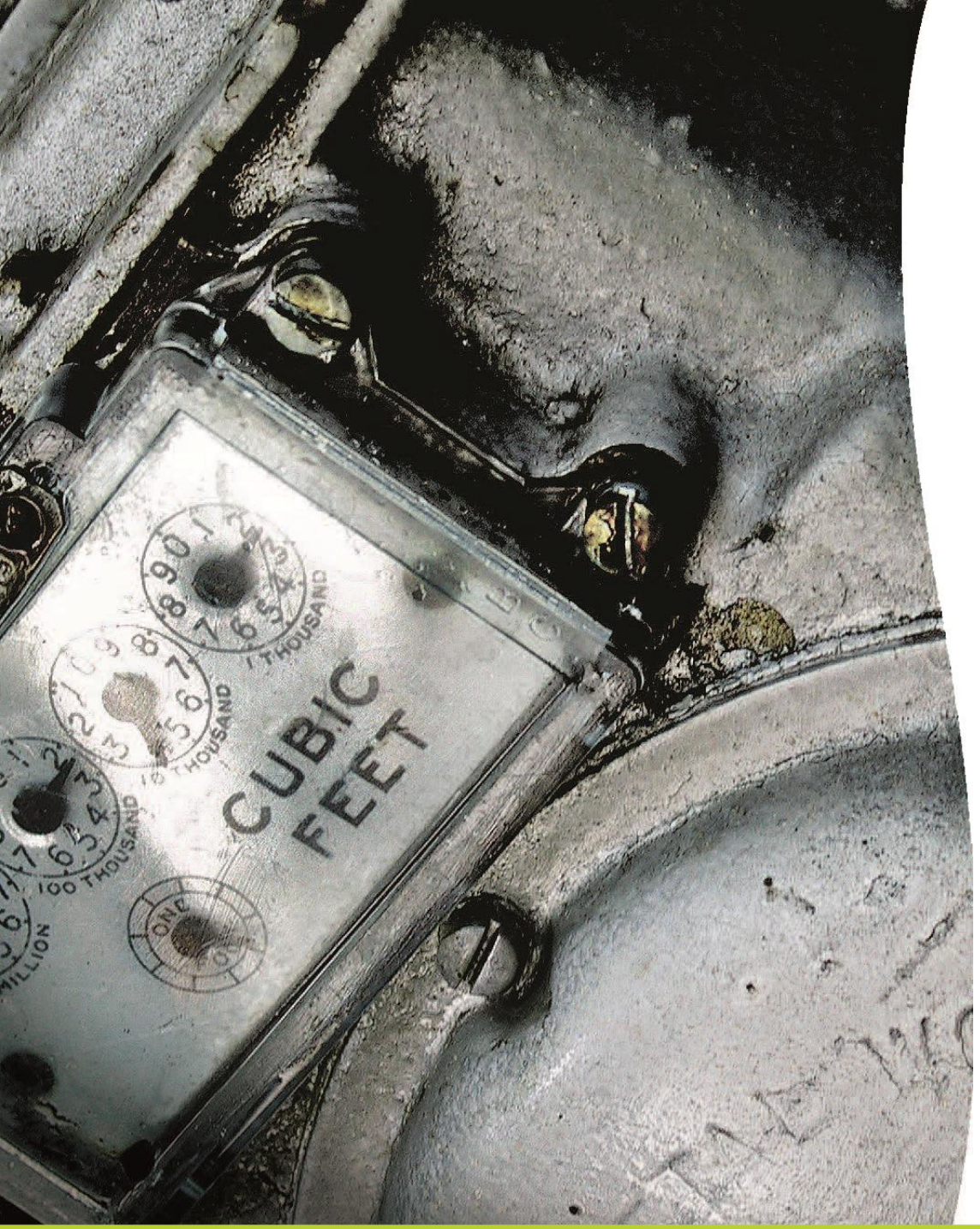
AGA American Gas Association

Methane Reductions: Continuing the Downward Trend

The American Gas Association, founded in 1918, represents more than 200 local energy companies that deliver clean natural gas throughout the United States.

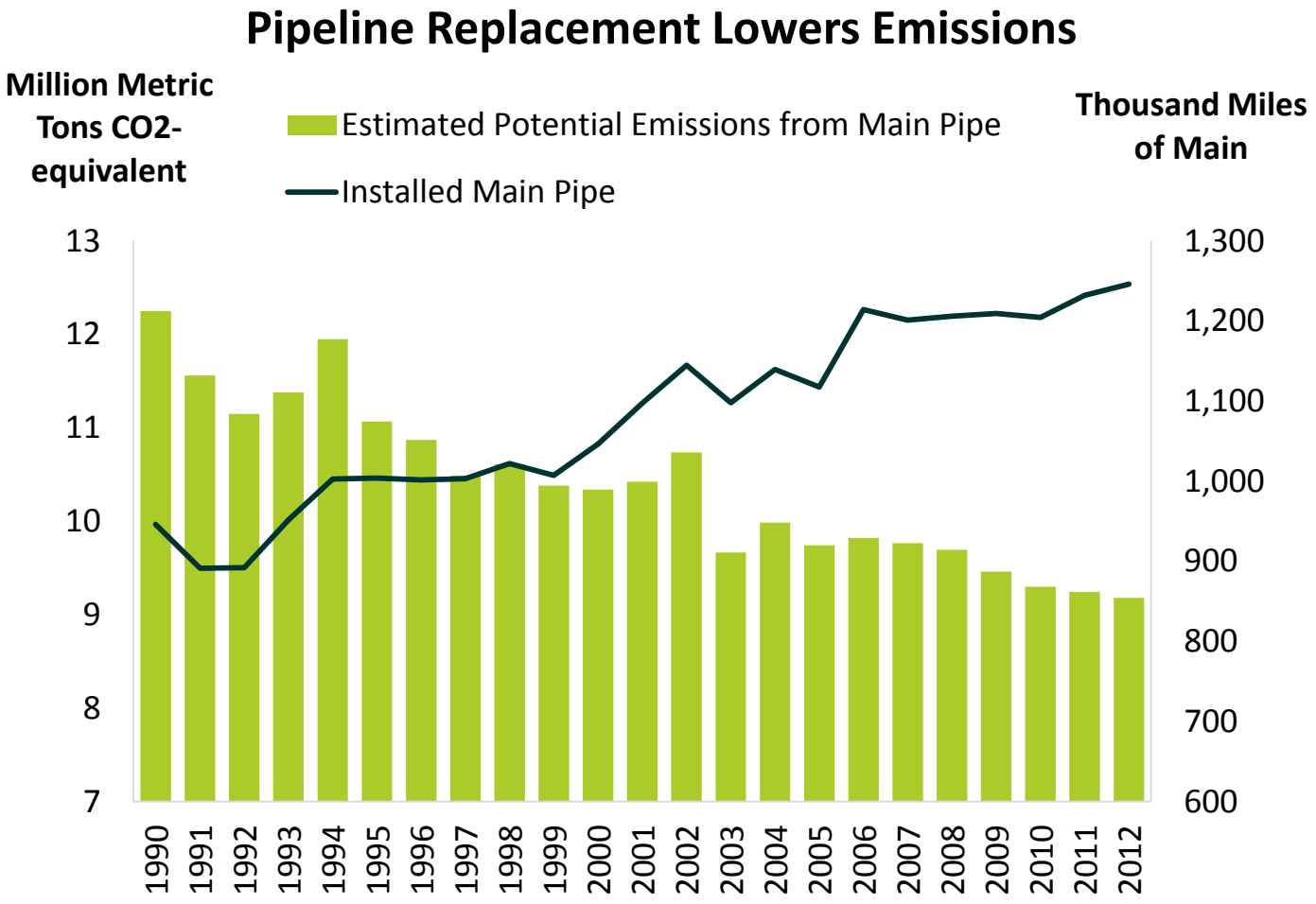
There are more than 72 million residential, commercial and industrial natural gas customers in the U.S., of which 95 percent — just under 69 million customers — receive their gas from AGA members.

AGA is an advocate for natural gas utility companies and their customers and provides a broad range of programs and services for member natural gas pipelines, marketers, gatherers, international natural gas companies and industry associates. Today, natural gas meets more than one-fourth of the United States' energy needs.



- **Big Picture – Demonstrating Value of Natural Gas**
- **Key to Reducing Natural Gas Emissions:**
  1. **Measure more accurately**
  2. **Share best practices**
  3. **Develop more cost-effective technologies**

Emissions Have Declined Even as Pipeline Miles Have Grown



Source: AGA Analysis based on Department of Transportation data and EPA *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2012*

Baseline Emissions

How much to we emit?

And why does it matter?

Natural Gas is a Climate Solution – But Do We Need to Reduce Emissions More?

2012 Study by Dr. Ramon Alvarez:

Switching to natural gas provides immediate climate benefits - IF methane emissions –

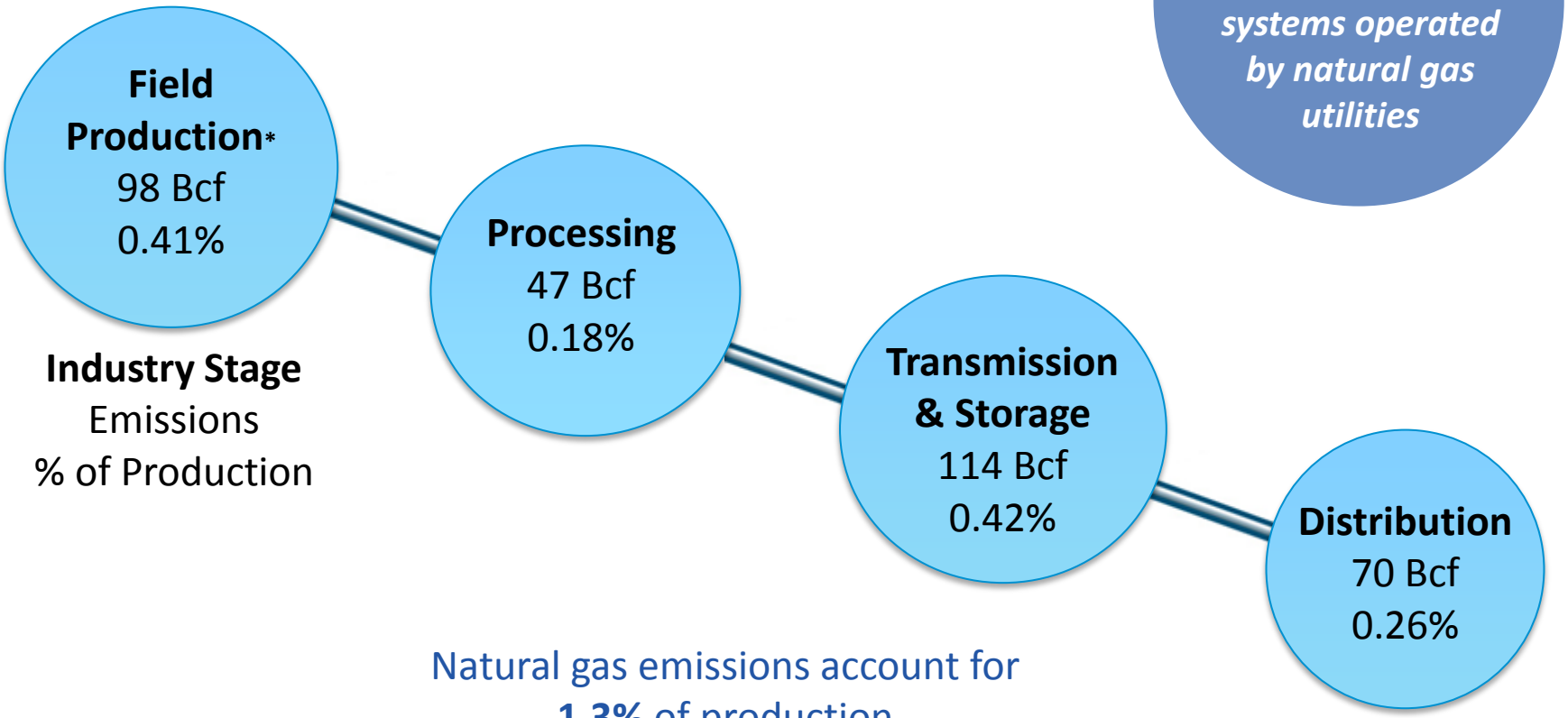
- **3.2 % - Power Plants – Coal to Nat Gas**
- **1.4% - Light Duty Vehicles – Gasoline to Nat Gas**
- **1% - Heavy Duty Vehicles**

- **EPA Inventory: Methane already down to 1.3 % of annual production… and we think it is actually lower**

Natural Gas Emissions as Percentage of Production

Only **0.26%** *of produced natural gas is emitted from systems operated by natural gas utilities*

Total natural gas production
30,000 Bcf (2013)



Natural gas emissions account for **1.3%** of production

* Includes natural gas fraction of oil well production.
Source: U.S. Department of Energy and U.S. Environmental Protection Agency, April 2015 Inventory

EPA Inventory

- Annual Inventory of Greenhouse Gas Emissions in the U.S. (April 15, 2015) covers emissions 1990-2013
- Emissions from entire natural gas value chain in 2013 = **1.3%** of annual produced natural gas
- Of this – **only 0.26%** of produced natural gas was **emitted from distribution systems**
- Estimates are based on 20-year old emission factors for plastic pipe, cast iron, bare steel, etc.
- **Newer data show distribution system emissions are actually much lower than EPA estimates**
    - **Distribution: 0.1% - Lamb, WSU (2015)**

EPA Inventory

- EPA proposing to update Inventory with new data
- AGA filed comments Jan. 14, 2016 on Distribution
- New proposal for Transmission and Storage changes – released January 20 – Comments due Feb. 3, 2016
- Tight schedule
- EPA required by treaty to publish Inventory on April 15 each year

Top-Down vs. Bottom-Up Studies

- **"Bottom-up" studies –**
  - Measure emissions flow rate directly from specific sources
  - Multiply average measured emissions times number of widgets or miles of pipe to estimate overall emissions
- **"Top-Down" studies –**
  - **Measures atmospheric concentrations – from airplanes, towers or vehicles**
- **Environmental Defense Fund (EDF) Methane Studies:**
  - **Production:** Texas University (TU)- EDF Production study published Sept. 2013 –
    - emissions from well completions much lower than EPA estimated
    - Partly offset by higher emissions from pneumatic valves
    - Net result somewhat lower than EPA Inventory estimate

How much do we emit? Reconciling the Gap

- **"Bottom-up" Studies -** Measure Measurements of Methane Flow Rates from Equipment –
  - Examples:
    - EPA Inventory based on GRI 1992 Study
    - Lamb, Washington State University (WSU)-EDF March 2015 Study
  - ➢ **Emissions over value chain 1.3% (2015 Inventory)**
- **"Top-Down" Studies -** Measure Methane Concentrations in Atmosphere – from planes, towers, or cars
  - Examples:
    - Harvard Boston Study Jan. 2015
    - EDF-Google Car Methane Mapping – Los Angeles May 2015
  - ➢ **Claim Emissions 2-3 times larger than EPA Inventory (2-3% of annual production over value chain)**

Reconciliation Studies

- **EDF – NOAA Barnett Shale (Dec. 2015)**
  - Reconciled the gap
  - Increased bottom-up
    - by collecting robust “activity data” – e.g. facility counts – in Fort Worth area
    - Plus scaled up by modeling estimated frequency of high-emitting facilities (e.g. stuck valves, intermittent venting)
  - Decreased top-down with source attribution
  - Concluded emissions in the Barnett 50% higher than EPA Inventory estimate for Barnett

Reconciliation Studies

DOE JISEA – Mid-Continent Study

- Underway – field measurements Oct. 2015
- Supported by 4 producers and AGA
- Bottom up/ Top down measurements across value chain at the same time, in the same place
- Improved ethane equipment - distinguish natural gas from biogenic sources

- **Publication expected Fall 2016**

ICF Synthesis Study for Natural Gas Council

- Evaluates @ 70 methane studies over past 5 years
- Synthesizes findings and addresses misinterpretations
- Release planned this winter 2016

Methane Reductions

Voluntary?

Or

By Rule?

EPA Methane Rules & Programs

1. **Mandatory regulations for upstream and midstream sources** –
   - **New Source Performance Standards (NSPS)**
   - **Control Techniques Guidelines (CTG) for Existing Sources in Nonattainment Areas**
   - **EPA resisting pressure for 111(d) rule for existing sources**

2. **Distribution – Voluntary only**
   - Methane Challenge

EPA Voluntary Methane Program – Enhanced Gas STAR Proposal

- **Two Pathways (Pick one, or do both)**
  1. **Best Practices**
  2. **One Future Percentage Reduction Approach**

- **Timing**
  - Initial proposal July 2015
  - Technical details released October 2015
  - AGA Comments Nov. 2015
  - Final Expected January 2016 - any day now…

Methane Challenge: Best Practices

How it works:

- Company voluntarily enters partnership agreement with EPA

- Commits to apply at least one "Best Practice" --
  - across its operations
  - (for gas utility – within any one state)
  - by 2025

Methane Challenge: Best Practices

List of Best Practice Options for Distribution (pick one or more):

1. **Replace cast iron or unprotected steel mains –** annual percentage based on size of company's starting inventory
2. **Replace cast iron and unprotected steel services**
3. **Monitor and repair M&Rs** (EPA asked whether to drop this)
4. **Reduce Blowdown emissions** for *non-emergency* work on mains 60 psi or more "by at least 50% from total *potential emissions* each year." (AGA: >60 psi)
    - (1) route gas to a compressor or capture system or
    - (2) route gas to a flare; or
    - (3) route gas to a low pressure system; or
    - (4) use hot tapping
5. **Enhance Damage Prevention Measures**

AGA Requested Changes - Mains

Tier	LDC's Inventory as of Jan. 1, 2016* of Cast Iron and Unprotected Steel Mains	% Annual Replacement/Repair
1	<500 miles	5%
2	500 – 1,000 miles	4%
3	1,001-1,500 miles Or over 2 miles/1000 customers	3%
4	1,500 miles-3,000 miles Or over 3 miles/1000 customers	2%
5	>3,000 miles	1.5%

EPA Methane Challenge – One Future Pathway

"One Future" Would Run Percentage Reduction Approach:

- Consortium of companies working to reduce emissions from value chain by 30% - from 1.3 % to 1 % or less of annual production
- **Two options likely within this second approach:**

1) **By 2025, reduce company's emissions intensity to the goal for the sector – e.g. 0.2% of a distribution company's throughput.**

OR

1) **By 2025, reduce company's emissions intensity by 30 percent from the company's current baseline (e.g. if 0.4% currently, reduce to 0.28% of annual throughput)**

… Details still being worked out

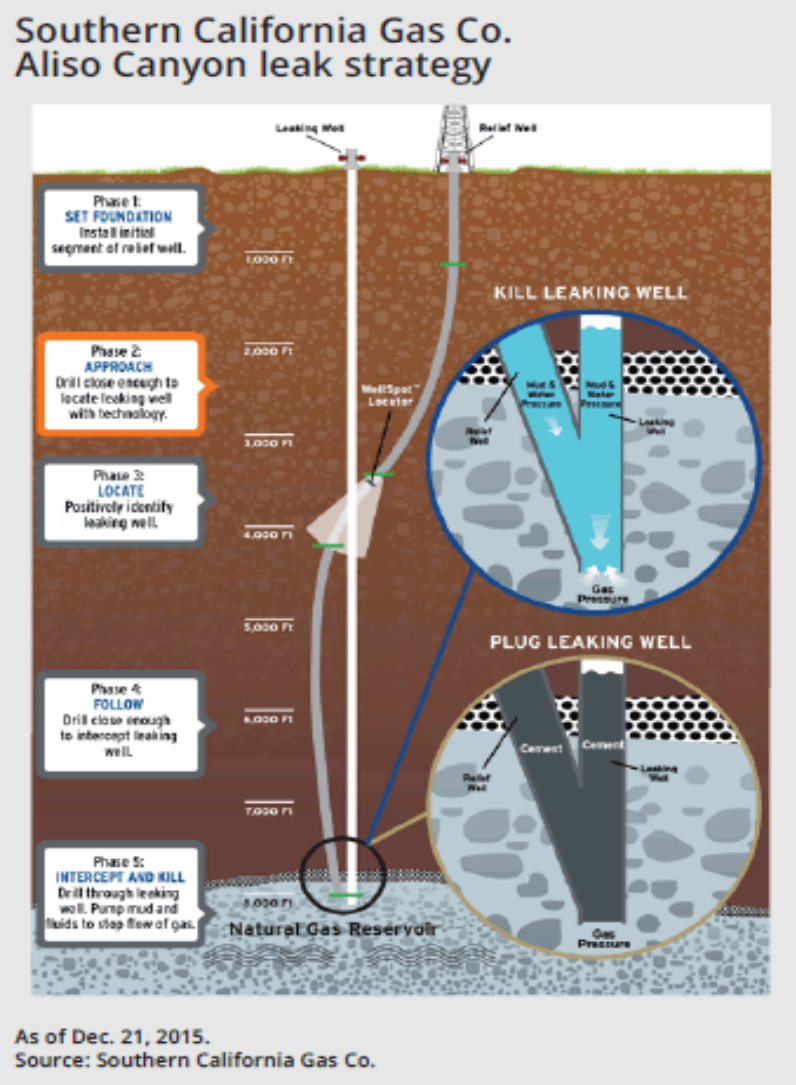
Methane Reductions

High Emitters

and

Unusual Events

Aliso Canyon Strategy



As of Dec. 21, 2015.
Source: Southern California Gas Co.

- Well leak detected October 23, 2015.
- Measured November 28 – 58,000 kg emitted per hour.
- Reduced to 23,400 kg per hour by January 8, 2016.
- Field has gone from 90 percent full in October 2015 to 37 percent full by January 10, 2016.
- By mid-January had leaked about 2 *million* tonnes of CO2 equivalent.
- US emits 5-6 *billion* tonnes of greenhouse gases (CO2 equivalent) per annum.
- 80 Bcf + working gas capacity.

"Methane emissions are a long-term reputational risk for the industry. Methane reduces the climate benefits of natural gas…"

Environmental Defense Fund, Rising Risk (Jan. 2016)

Conclusion

- Get facts straight
- Craft strategy to address and reduce

- Ultimately: Make the case for Abundant, Affordable, American, Clean Natural Gas as a *Foundation* for a Low Carbon Future

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