

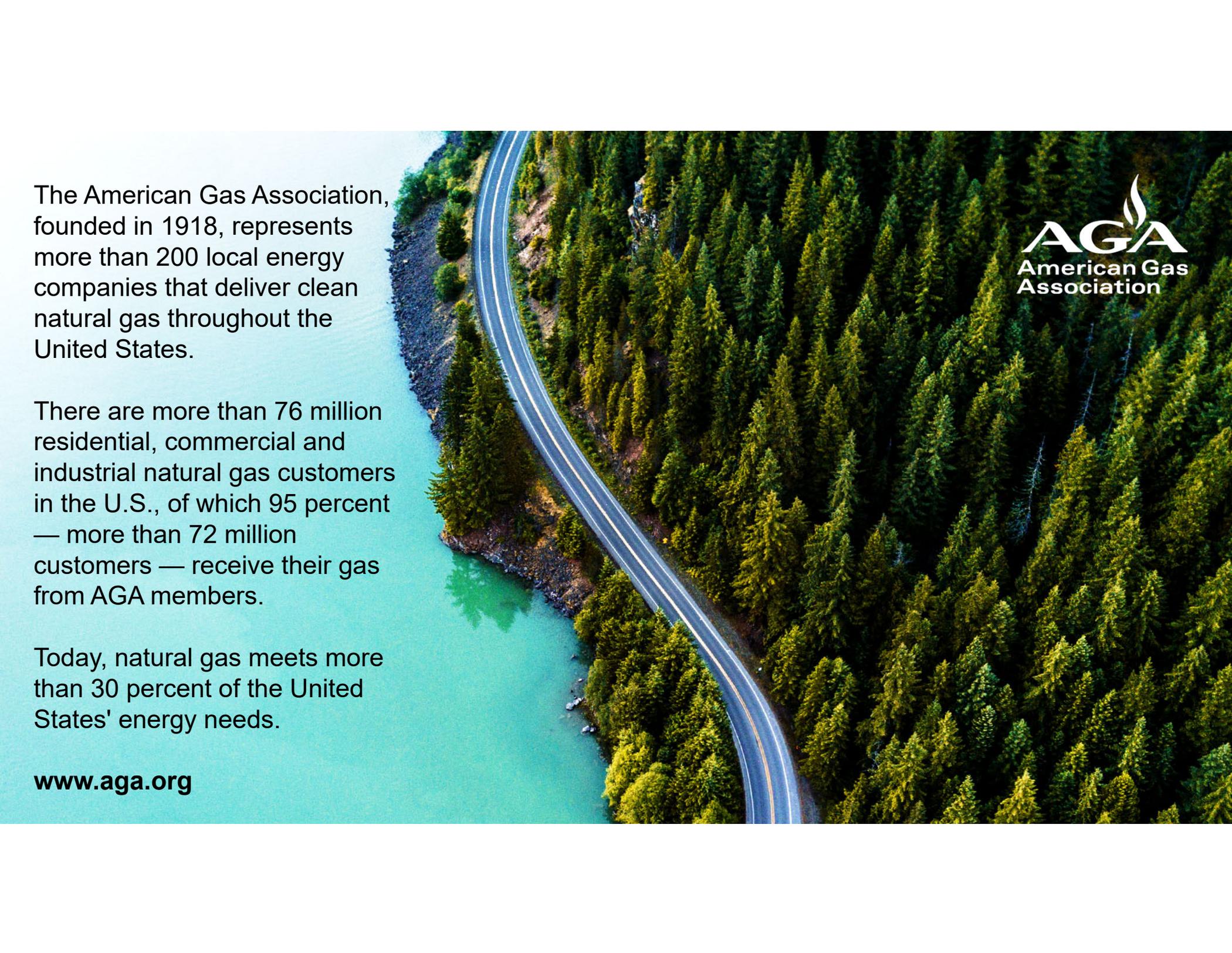
ARPA-E REPAIR ANNUAL MEETING

PUBLIC MEETING

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An aerial photograph showing a two-lane asphalt road that curves through a dense, green forest. To the left of the road is a body of water with a light blue-green hue. The forest is composed of many tall, thin evergreen trees. The lighting suggests a bright day, with some shadows cast by the trees.

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

Today, natural gas meets more than 30 percent of the United States' energy needs.

www.aga.org

The logo for the American Gas Association (AGA). It features the letters "AGA" in a large, bold, white serif font. Above the letter "A" is a stylized white flame icon. Below "AGA" are the words "American Gas Association" in a smaller, white, sans-serif font, stacked in two lines.

American Gas
Association

Fast Facts

- In 2019, United States greenhouse gas emissions totaled 6,558 million metric tons of carbon dioxide equivalent, down 12 percent from 2005.
- Methane emissions from natural gas distribution systems have declined 69 percent from 1990 levels. This drop occurred even as the industry added approximately 788,000 miles total to serve 21 million more customers.
- Carbon emissions from the average natural gas home **decline 1.2 percent** per year.
- Increased use of natural gas is the single largest factor in power sector emissions reductions reaching **27-year lows**.
- Natural gas industry and utilities invest **\$3.9 million everyday** to help customers reduce their carbon footprints.

AGA's Climate Change **POSITION STATEMENT**

The American Gas Association is committed to reducing greenhouse gas emissions through smart innovation, new and modernized infrastructure, and advanced technologies that maintain reliable, resilient and affordable energy service choices for consumers.



10 commitments
for reducing emissions.

Eight principles
for an effective national
policy approach to
addressing climate change.

aga.org/climate

AGA Actively Tracks Member Company Emissions Goals

April 2020

- **16** AGA member companies have a net-zero, carbon neutral, or 100% clean energy goal
- **45 percent** of AGA member companies' gas throughput comes from a utility with a carbon-neutral, net-zero commitment or clean energy goal



November 2021

- **30** AGA member companies have a net-zero, carbon neutral, or 100% clean energy goal
- **65 percent** of AGA member companies' gas throughput comes from a utility with a carbon-neutral, net-zero commitment or 100% clean energy goal

INDUSTRY INITIATIVES

- Industry efforts to reduce emissions:
 - EPA Natural Gas STAR: 37 Members
 - EPA Methane Challenge: 48 Members
- Participation in studies to improve the accuracy of methane detection, measurement, and/or emission factors.
 - WSU-EDF Lamb Gas Distribution Methane Study
 - CSU-NOAA-DOE Basin Methane Top- Down/Bottom-Up Reconciliation Study
 - NYSEARCH-EDF Study of Methane Detection Technologies
 - GTI-DOE Study of Plastic and HDPE Pipe, GTI-DOE Studies of Residential, Industrial & Commercial Customer Meters
- Publications
 -  AGA Blowdown Emissions Reduction White Paper
 -  Considerations for Eliminating Hazardous Leaks and Minimizing Releases of Natural Gas

Pending Paper: Impact of Hydrogen on Pipeline Materials

PROVEN STRATEGIES

REDUCING RELEASES REDUCES EMISSIONS

Investing in innovation to further enhance pipeline safety efforts allows for the safe and reliable delivery of natural gas to 180 million customers.

PHMSA data shows cast iron and bare steel pipelines are prone to leak. Replacement and Rehabilitation supports:

- Pipeline Safety
- Reliability and
- Reduction in emissions

Excavation damage continues to be a leading cause of pipeline incidents.

2020 data: 46% of all hazardous leaks on were on distribution mains and released 245,000 mcf of gas

245k mcf = 34 MM miles driven, 15 MM lbs. coal burned, or enough electricity to power over 2400 homes for year

R&D can support rehabilitation of vintage pipes and find ways to leverage technology to prevent excavation damage

SAFETY

Prioritizing public safety first and foremost

- Traditional leak classification and leak repair timeframes are based exclusively on their risk and potential impact to public safety.
- Grade 1 and Grade 2 leaks have explicit repair timeframes.
- Responding promptly to emergency and integrity work is critical

SAFETY

Prioritizing public safety first and foremost

- AGA supports moving beyond public safety to a focus on protecting the environment:
 - 1) Reduce “immediate” sources of methane emissions;
 - 2) Address repair timeframe for larger leaks which are non-hazardous to the public; and
 - 3) Supplemental leak surveys focused on larger leaks which are non-hazardous to public safety.

PIPELINE LEAK DATA

Investing in pipeline modernization enhances the safe and reliable delivery of natural gas to 180 million customers. It also reduces emissions.

- PHMSA data shows cast iron and bare steel pipelines are prone to leak. Replacement or Rehabilitation supports:
 - Pipeline Safety
 - Reliability and
 - Reduction in emissions
- Statistics: Just **21%** of distribution operators have CI &/or bare steel BUT these operator account for -
 - **95%** of corrosion leaks on mains
 - **92%** of natural force leaks on mains
 - **91%** of pipe/weld/joint failure leaks
 - **97%** "other cause" leaks on mains
 - **76% of ALL KNOWN LEAKS**

PIPELINE REPAIR

Investing in pipeline modernization enhances the safe and reliable delivery of natural gas to 180 million customers. It also reduces emissions.

- PHMSA data shows cast iron and bare steel pipelines are prone to leak. Replacement supports:
 - Pipeline Safety
 - Reliability and
 - Reduction in emissions
- Not all leaks require pipeline replacement.
- Repair tools that avoid disruption to gas service are necessary in certain situations.

PIPELINE REPLACEMENT PROGRAMS

Investing in pipeline modernization enhances the safe and reliable delivery of natural gas to 180 million customers. It also reduces emissions.

Remaining Distribution Cast Iron and Bare Steel Pipeline by State

Cast Iron

Year: 2020

State	Main Miles [△] ▼	% of Total Main Miles
NEW JERSEY	3,412	9.6%
NEW YORK	2,773	5.6%
MASSACHUSETTS	2,713	12.4%
PENNSYLVANIA	2,284	4.7%
MICHIGAN	2,057	3.4%
CONNECTICUT	1,132	13.6%
ILLINOIS	1,072	1.7%
MARYLAND	1,058	6.9%
RHODE ISLAND	660	20.5%
ALABAMA	592	1.8%
MISSOURI	552	1.9%
DISTRICT OF COLUMBIA	402	33.0%

Bare Steel

Year: 2020

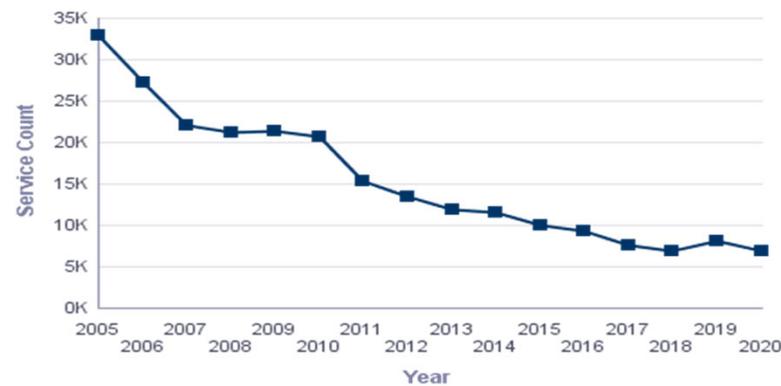
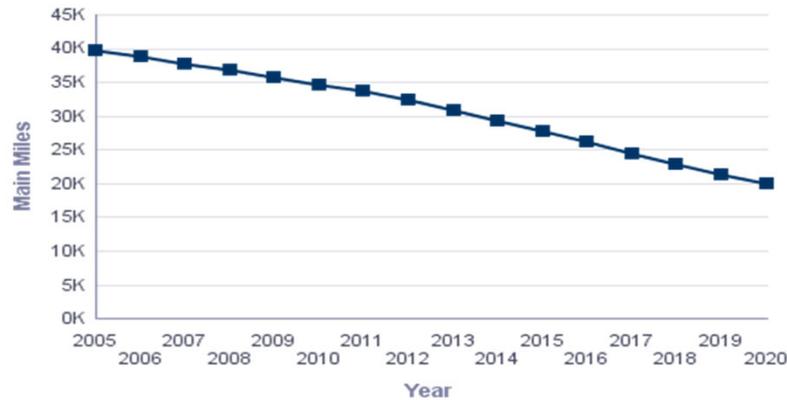
State	Main Miles Bare Steel [△] ▼	% of Total Main Miles
OHIO	5,870.90	9.9%
PENNSYLVANIA	5,827.47	12.0%
NEW YORK	4,692.56	9.5%
TEXAS	4,272.80	3.9%
KANSAS	3,676.75	15.7%
CALIFORNIA	3,470.09	3.2%
WEST VIRGINIA	2,566.64	23.3%
MASSACHUSETTS	1,150.39	5.3%
OKLAHOMA	1,138.07	4.2%

- <https://www.phmsa.dot.gov/data-and-statistics/pipeline-replacement/cast-and-wrought-iron-inventory>
- <https://www.phmsa.dot.gov/data-and-statistics/pipeline-replacement/bare-steel-inventory>

PIPELINE REPLACEMENT PROGRAMS

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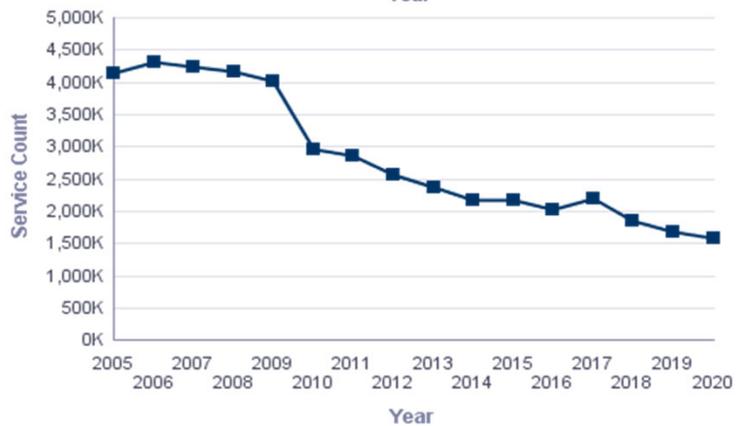
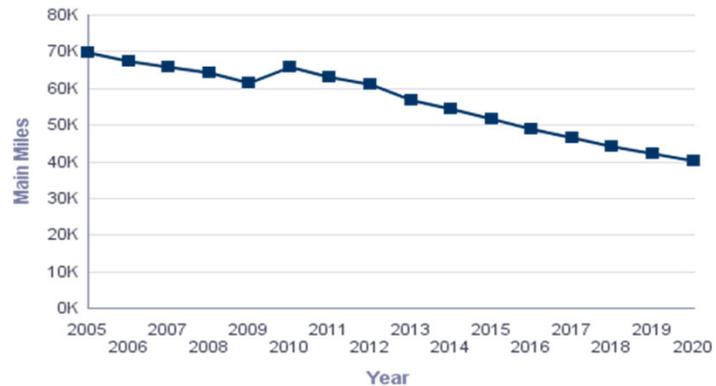
- Cast iron distribution pipe: Since 2005
 - Miles of main cut in half
 - Number services down nearly 80%



PIPELINE REPLACEMENT PROGRAMS

Investing in pipeline modernization enhances the safe and reliable delivery of natural gas to 180 million customers. It also reduces emissions.

- Bare steel distribution pipe: Since 2005
 - Miles of main down 42%
 - Number of services down 62%



PIPELINE REPLACEMENT PROGRAMS

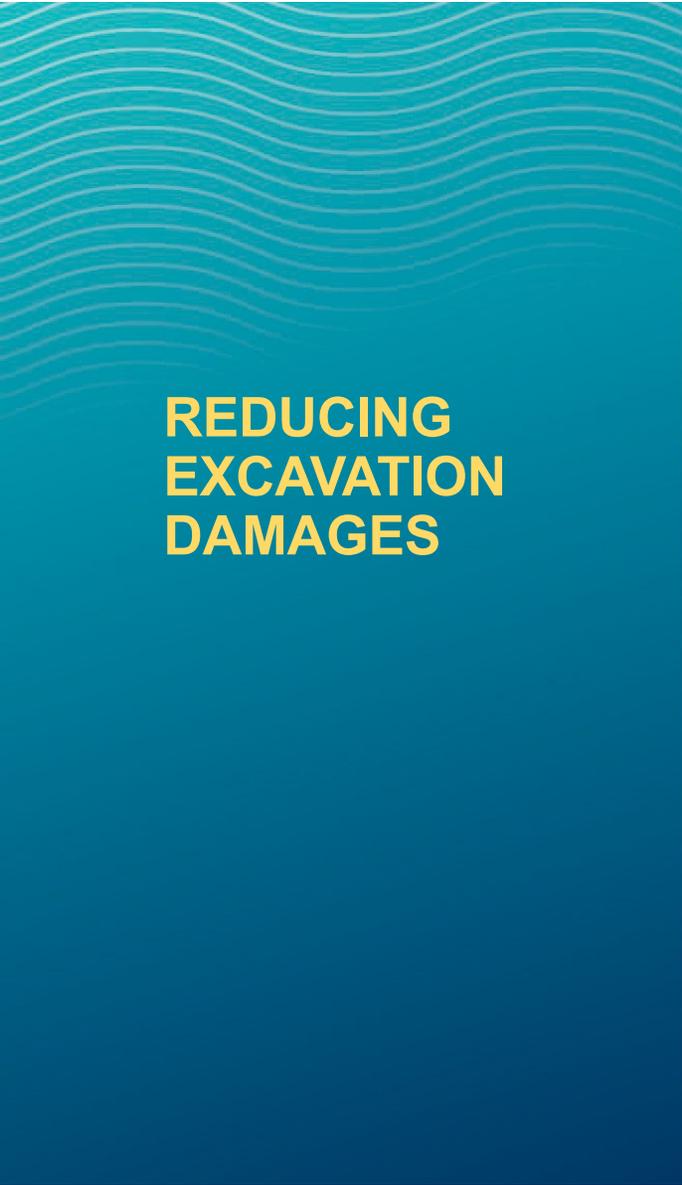
Investing in pipeline modernization enhances the safe and reliable delivery of natural gas to 180 million customers. It also reduces emissions.

- As of 2020, 36 member companies have indicated they have an accelerated pipeline replacement program. Most focus on vintage materials.
 - Program metrics are typically approved by the member company's local regulatory authority.
 - One example metric is dollar spent per mile of main replaced.
 - REPAIR's goal of reducing cost of rehabilitation per mile of main is crucial to aide utilities in targeting larger diameter pipelines.

PIPELINE REPLACEMENT PROGRAMS

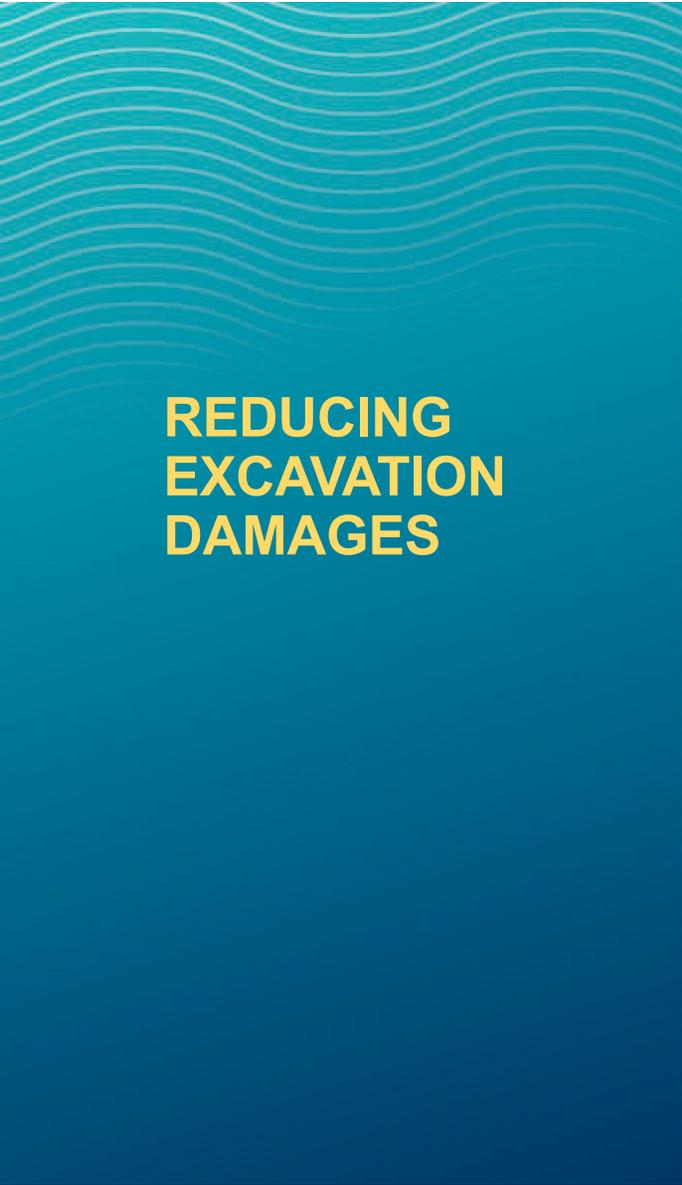
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- As of 2020, 36 member companies have indicated they have an accelerated pipeline replacement program.
 - Another crucial goal of REPAIR is to have regulatory agencies recognize REPAIR rehabilitation methods as a method of replacement of vintage materials
 - An added benefit of rehabilitating versus replacement of large diameter pipelines is avoiding space constraints



REDUCING EXCAVATION DAMAGES

- Excavation damages continue to be a leading cause of pipeline incidents.
- 2020: Excavation damage was -
 - 29% of serious distribution incidents
 - 36% of significant distribution incidents
 - 46% of all hazardous leaks on D mains
 - Released ~245,000 mcf of gas
 - 245k mcf = 34 MM miles driven, 15 MM lbs. coal burned, or enough electricity to power over 2400 homes for year*
- Operators need help from state authorities to actively enforce One Call Laws on excavators who fail to notify 811 or fail to follow safe excavation practices, such as hand-digging around underground utilities.



REDUCING EXCAVATION DAMAGES

- Excavation damages continue to be a leading cause of pipeline incidents.
- Tracking and Traceability is an important initiative being undertaken by utilities.
- The need to accurately map and locate facilities is crucial to avoid excavation damage.
- Technologies that allow utilities to collect information and easily update their mapping systems will be useful now and into the future.



NEW TECHNOLOGY ACCEPTANCE

- The bold mission of the REPAIR program seeks to aide utility companies in increasing safety and reliability of their systems.
- Partnering with utility companies to perform pilots and field tests
- Showcasing technology at trade shows and conferences
- Be aware of state government energy master plans to ensure strategy alignment



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