



**Maryland**  
Department of  
the Environment

# Minimizing Methane Emissions from Natural Gas Compressor Stations and other Related Equipment



# Presentation Outline

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- Background
  - Why are we pushing this issue
- Methane Emission Minimization Plans
  - Overview - Phasing
  - Regulatory Requirements
  - Non-regulatory, Data-Driven Requirements
- Discussion/Comments
- Next Steps



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# Why is MDE Pushing this Issue

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- Maryland has one of the country's most aggressive programs to address climate change
- Methane is a highly potent greenhouse gas that needs to be acted upon quickly because it is a short-lived climate pollutant (SLCP)
- Leaking methane has been identified by researchers and regulators as a major issue that needs to be addressed
- Maryland has 3 initiatives started to address leaking methane
  - Compressor stations and other related equipment (today's meeting)
  - Landfills
  - Wastewater Treatment Plants





# The Greenhouse Gas Emission Reduction Acts (GGRA) of 2009 and 2016

- Originated in 2007 by Executive Order which resulted in a 2008 “Climate Action Plan”
- This led to the “Greenhouse Gas Emission Reduction Act” of 2009
  - 25 % Greenhouse Gas (GHG) Emission reduction by 2020
- 2009 law reauthorized in 2016 ... new goals added
  - 40 % GHG reduction by 2030
- The acts also require that the States GHG reduction plans to support a healthy economy and create new jobs





# The Maryland Commission on Climate Change (MCCC)

- MCCC codified into law in 2015
- Establishes a balanced, bipartisan Commission
  - Representatives from state and local government, the private sector, environmental advocacy groups, labor, the general public and more
- Basic charge of the Commission:
  - Provide recommendations on how to reduce GHG emissions and adapt to the impacts of climate change
- Full Commission and four working groups (Mitigation, Adaptation, Science and Communications) meet routinely
  - All meetings open to public
- MCCC has recommended that reducing in-state methane leakage be a very high priority





# The U.S. Climate Alliance

- Maryland joined the U.S. Climate Alliance (USCA) on January 10, 2018
  - Originally, an alliance of 12 states ... now 22 states
- Basic mission ... to meet the goals of the Paris Climate Agreement ... at least 26-28 percent below 2005 levels by 2025
- Multiple working groups ... one focused on SLCP
  - Pushing efforts to reduce methane, hydroflouorocarbons (HFCs) and black carbon
- Besides our work on methane, Maryland is joining other states like CA, and NY to adopt 2019 regulations to phase out the use of HFCs





# Climate Alliance States

## *Recent Activity*

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- California law requires reducing emissions of methane and HFCs by 40 percent, below 2013 levels by 2030
- Massachusetts is the first state in the country to impose annually declining methane emissions limits (for 2018, 2019, and 2020) on natural gas distribution system operators
- Colorado was the first state to regulate methane emissions from oil and gas operations. The 2014 rules will prevent an estimated 65,000 tons per year of methane
- New York has developed a Methane Reduction Plan, including 25 measures across 5 agencies, to cut methane from oil and gas infrastructure, waste management, and agriculture

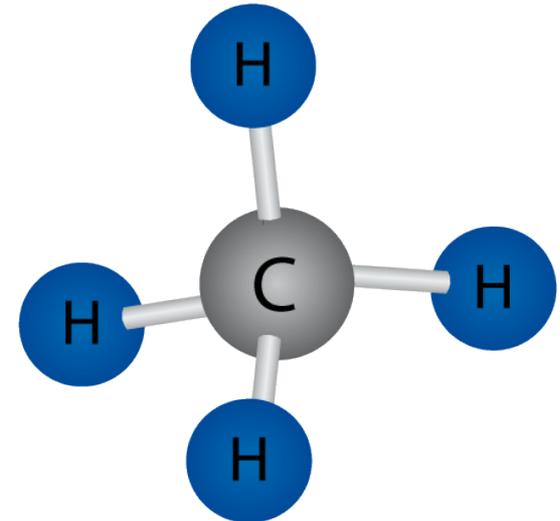


# Methane and Climate Change

## ... the Basics

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- The second most prevalent greenhouse gas emitted in the U.S.
  - About 10% of all U.S. greenhouse gas emissions
- The atmospheric lifetime of methane is much shorter than carbon dioxide (CO<sub>2</sub>)
- On a per unit basis, methane is at least 25 times more potent at trapping heat in the atmosphere than CO<sub>2</sub> over a 100 year period, and about 72 times more potent over a 20 year period





# Natural Gas - Continued Growth

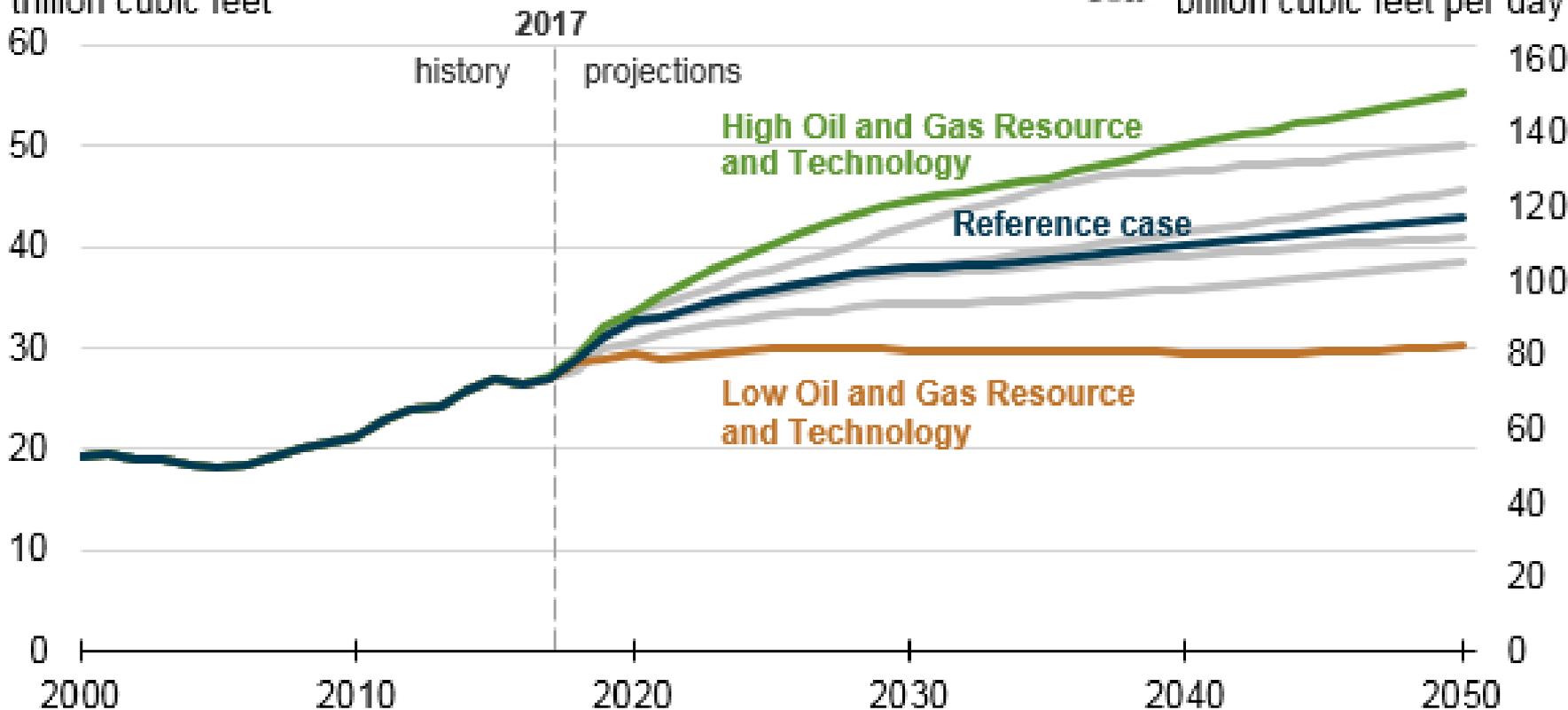
*US Natural Gas Production and Consumption are Expected to Keep Rising*

U.S. natural gas production (2000-2050)

trillion cubic feet



billion cubic feet per day

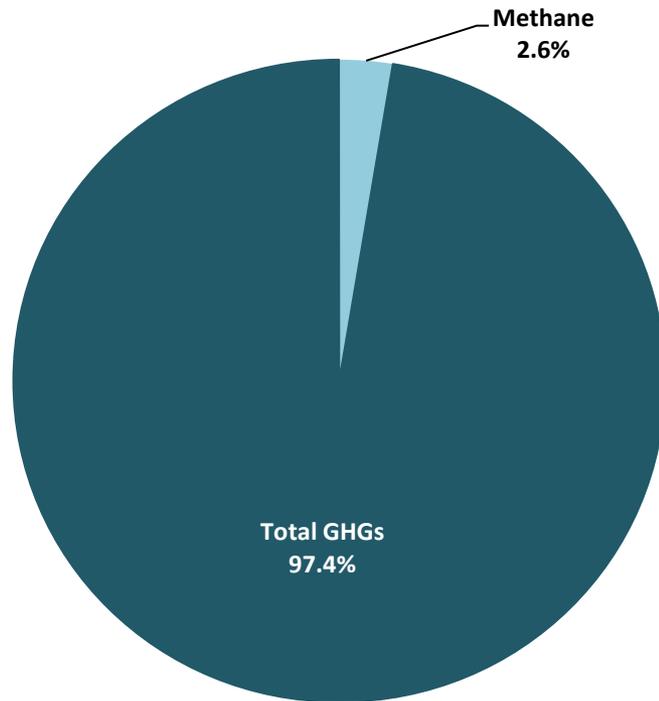


Source: U.S. Energy Information Administration, Annual Energy Outlook 2018

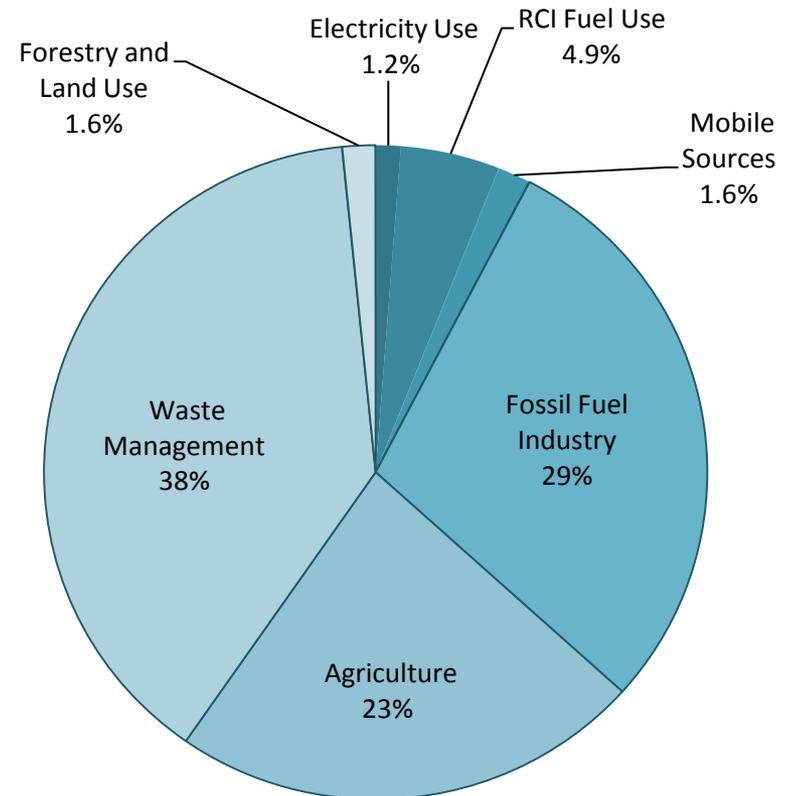


# Methane Emissions in Maryland

## All GHGs (2014)



## Methane Breakdown (2014)

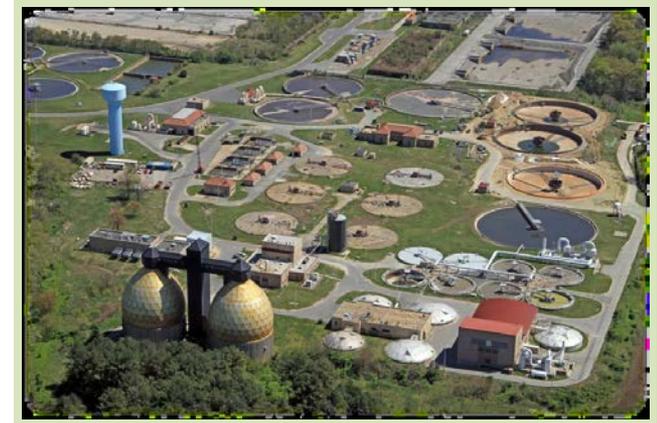


Using CO<sub>2</sub>e conversion  
of 21 at 100 year

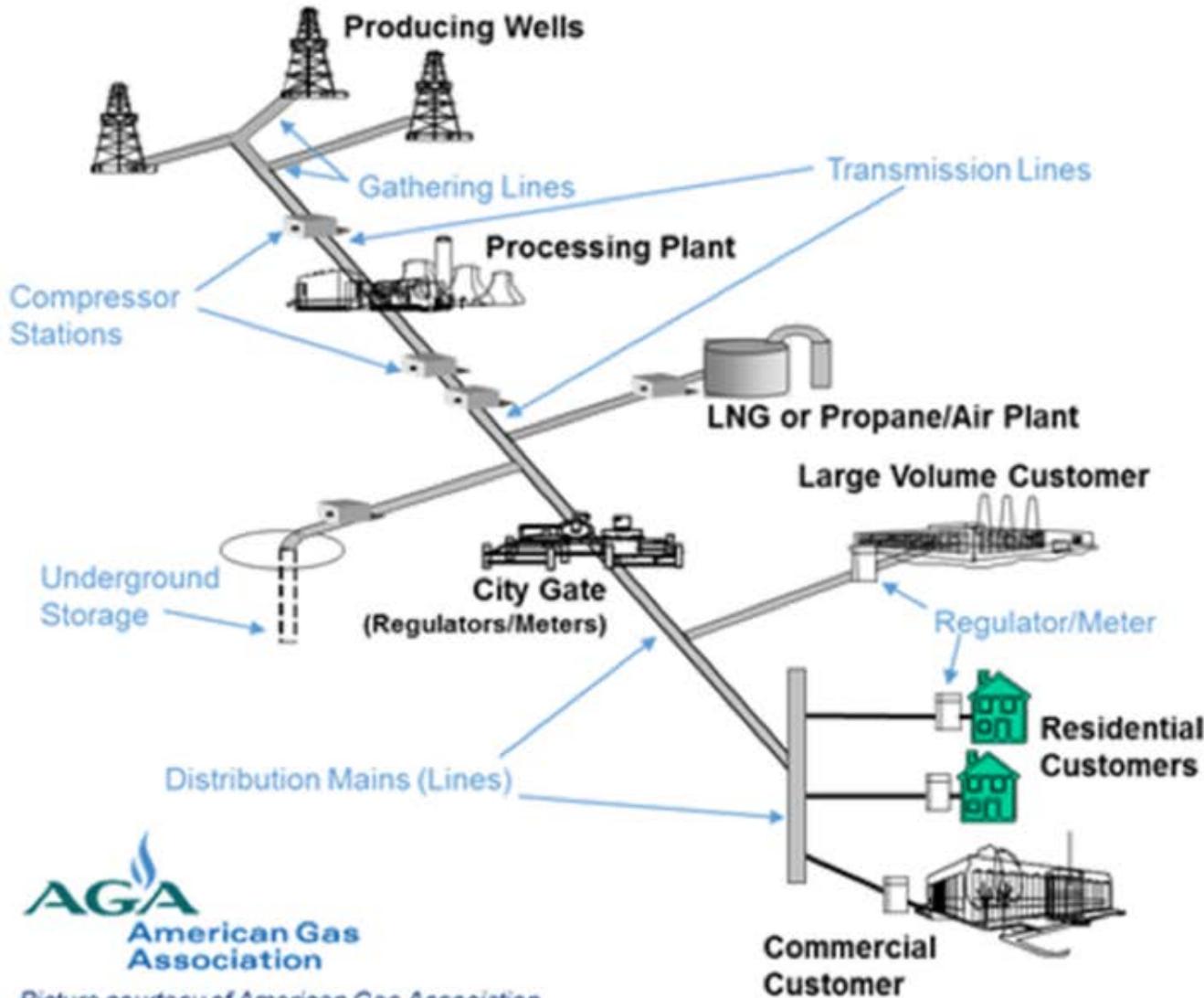


# Primary Methane Source Categories in Maryland

- Leakage and venting of methane (CH<sub>4</sub>) from oil and gas fields, processing facilities, and natural gas pipelines
- Municipal and industrial landfills
- Wastewater management
- Fugitive CH<sub>4</sub> emissions released during coal mining
- Non-energy CH<sub>4</sub> from enteric fermentation, manure management, and agricultural soils
- Wildfires and prescribed burns



# Oil and Natural Gas Industry in General



- Production**
- Pneumatic Controllers
  - Gathering/Boosting Stations
  - Tanks
  - Chemical Injection Pumps

- Gathering and Processing**
- Reciprocating Compressors
  - Centrifugal Compressors
  - Gas Engines
  - Blowdowns/Venting

- Transmission**
- Reciprocating Compressors
  - Station Fugitives
  - Engines
  - Pipelines

- Distribution**
- Mishaps (Dig-ins)
  - Residential
  - Mains - Unprotected Steel
  - Services - Unprotected Steel



Picture courtesy of American Gas Association

A bright sun shining through a blue sky with white clouds. The sun is positioned in the upper right quadrant, casting rays across the sky. The clouds are scattered and fluffy, with some larger ones on the left and right sides. The overall scene is bright and clear.

# **METHANE EMISSIONS MINIMIZATION PLANS**



# Methane Emission Minimization Plans (MEMPs)

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- MEMPs will be required from all significant sources with potential methane leakage issues
- Each MEMP will include:
  - Regulatory requirements
  - Non-regulatory, data-driven requirements
- Two phases of MEMPs
  - Transmission and Gathering/Processing Sectors ... First
  - Production (Wells)/Distribution Sectors... Second
  - Based upon emission reduction potential



A bright sun is positioned in the upper right quadrant of the image, casting a strong glow and creating a lens flare effect. The sky is a deep, clear blue, and several large, fluffy white cumulus clouds are scattered across the scene, particularly on the left and right sides. The overall atmosphere is bright and clear.

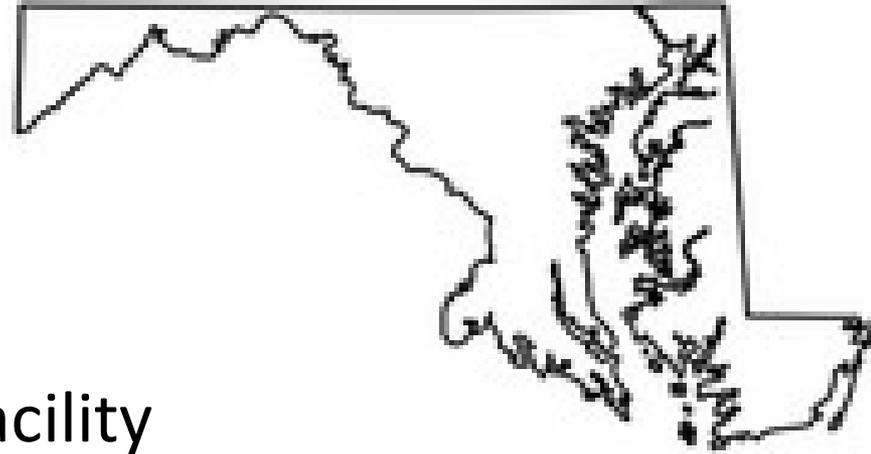
# PHASE 1 - THE TRANSMISSION SECTOR



# Transmission Sector - Sources Covered

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- Four compressor stations (~ 1,800 in the US)
  - Dominion, Myersville
  - Texas Eastern, Accident
  - TransCanada, Rutledge
  - Transco, Ellicott City
- One underground storage facility
  - Texas Eastern, Accident
- One import and liquefaction/export facility
  - Dominion, Cove Point



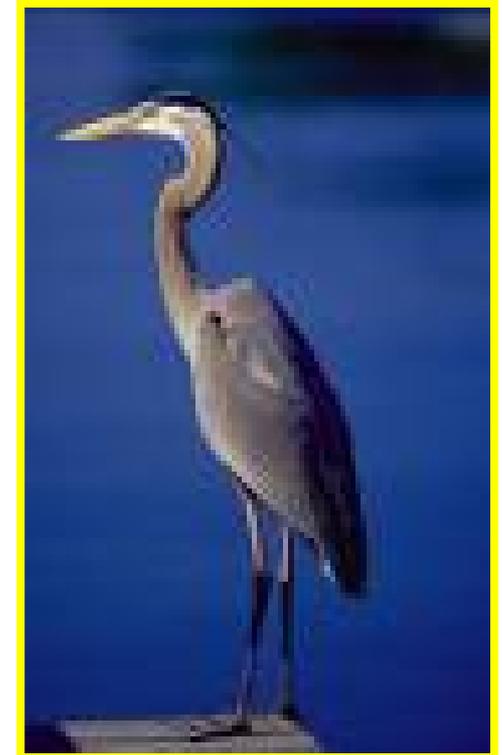


# Maryland Proposed Requirements

## *Where did they come from?*

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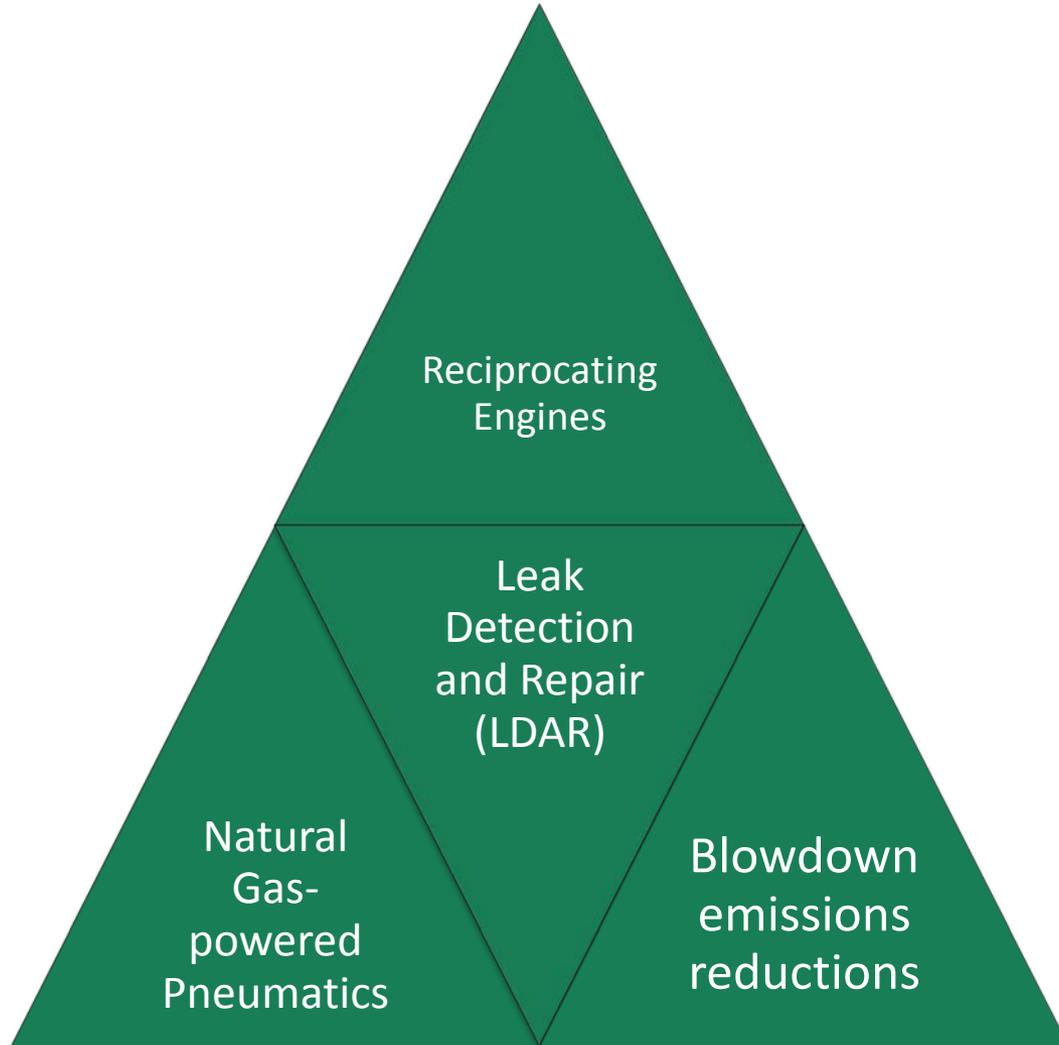
- Built from:
  - Methane mitigation programs in other states
    - Colorado, California, Pennsylvania, New York, others
  - EPA 2016 NSPS OOOOa
  - Review of stakeholder comments
  - Meetings with each facility and community and advocacy groups





# MEMP – Part I: Regulatory Requirements

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# Leak Detection & Repair (LDAR)

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- Facilities to submit initial monitoring plan
- Initial monitoring survey due within 90 days of effective date of regulation.
  - Within 90 days at the startup of new compression
- Quarterly monitoring using Optical Gas Imaging (OGI) or Method 21
  - Exception for electric engines
  - LNG specific requirements
- Quarterly and Annual record keeping and reporting.



# MEMP – LDAR Continued

- No reduction in frequency of quarterly survey proposed.
- Repairs should be made and certified within 30 days of discovering a leak
- Delay of Repair (DOR) provisions such as: requires a station blowdown or unsafe to shutdown

*(5) Repair Requirements.*  
*(a) Any leak found shall be successfully repaired or removed from service within 30 calendar days of initial leak detection.*  
*(b) Successful repair means confirmed to be under the fugitive leak threshold by passing a bubble test, being under 500 ppm with Method 21 or no visible emissions with an optical gas imaging (OGI) camera.*  
*(c) A delay of repair may be granted by the Department when the owner or operator can provide proof that:*  
*(i) The parts or equipment required to make necessary repairs will exceed greater than 30 days to deliver and have been ordered;*  
*(ii) Repairing a leaky component is technically infeasible;*  
*(iii) The repair requires a vent or compressor station blowdown; or*  
*(iv) The repair is unsafe to repair during the operation of the unit.*  
*(d) Leaking components under the delay of repair shall be clearly marked and the repair or replacement of leaking component or equipment must be completed during the next planned compressor station shutdown, vent blowdown, or within 7 days after the owner or operator receives parts or equipment needed to fix leaking component or equipment.*  
*B. Affected facilities that are natural gas compressor stations and natural gas underground storage facility with a potential-to-emit equal to or less than 25,000 metric tons of CO<sub>2</sub> equivalent per year, shall comply with the following leak detection and repair requirements:*



# MEMP – Pneumatic Devices

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- Bleed rate cannot exceed 6 standard cubic feet per hour
- Pneumatic devices will be subject to LDAR
- Additional requirement: Beginning Jan. 1, 2022 switch to electric or compressed air, or use vapor collection

*B. Beginning January 1, 2022, each natural gas-powered pneumatic device shall:*  
*(1) Collect all vented natural gas using the use of a vapor collection system; or*  
*(2) Use compressed air or electricity to operate.*

DRAFT - FOR DISCUSSION PURPOSES ONLY



# MEMP – Reciprocating Engines

- Rod packing flow rate required to be measured annually, or
- Vented gas is routed to a vapor control device and utilized

*A. Each reciprocating natural gas compressor and components at an affected facility shall comply with the leak detection and repair requirements specified in Regulation .03 of this chapter.*

*B. Control Measures.*

*(1) Beginning January 1, 2021, compressor vent stacks used to vent rod packing/seal emissions shall be controlled with the use of a vapor collection system as specified in Regulation .06 of this chapter; or*

*(2) A reciprocating natural gas compressor with a rod packing/seal with a measured emission flow rate greater than [0.51 – 2] standard cubic feet per minute (scfm), or a combined rod packing or seal emission flow rate greater than the number of compression cylinders multiplied by [0.51 – 2] scfm, shall be successfully repaired or replaced within 30 calendar days from the date of the initial emission flow rate measurement.*

*C. The reciprocating natural gas compressor rod packing/seal emission flow rate through the rod packing/seal vent stack shall be measured annually by April 1<sup>st</sup> of each year beginning in 2021 through direct measurement (high volume sampling, bagging, calibrated flow measuring instrument) while the compressor is operating at normal operating temperature.*



# MEMP – Blowdown Emissions

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## Require Blowdown Events to be Reported

- Affected facilities shall notify the Department prior to any planned blowdown event
- All methane emissions from blowdown events shall be reported to the Department annually by April 1<sup>st</sup>





# MEMP - Data Collection and Reporting

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- Extensive data collection and reporting will be required
- To be harmonized with other federal and state data collection and reporting requirements
- Annual emission report
- Transparency is a priority ... linked to community partnership processes required in the non-regulatory, data-driven requirements to be discussed later

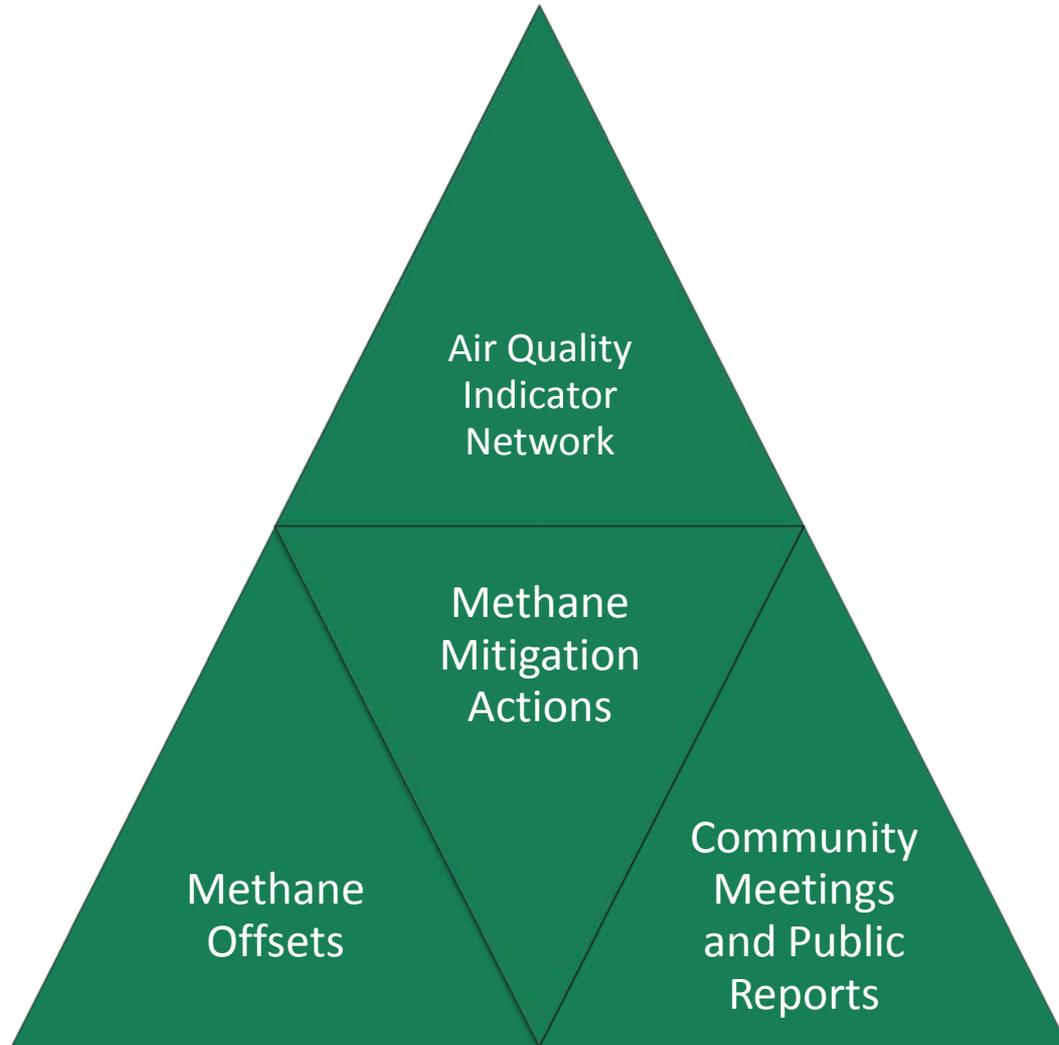




# MEMP – Part II

## Data-Driven Partnership Agreements

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# Emerging Emission Reduction Opportunities

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Company will voluntarily review and as appropriate implement emerging methane mitigation technologies and practices including, but not limited to:

- Blowdown venting methane emission reductions;
- Install lean burn compressor;
- Convert natural gas-driven chemical pumps;
- Replace bi-directional orifice meter with ultrasonic meters;
- Use add-on controls to reduce emissions from pneumatics;
- Move in fire gates at compressors;
- Test and repair pressure safety valves; and
- Use of YALE closures for emergency shutdown testing



# Support an Air Quality Indicator Network

- Companies to work with community to develop an air quality monitoring network
  - Cost not to exceed \$100,000 over 5 years
  - Focused primarily on other air pollutants ... not methane
  - Expected to focus on low-cost sensors
- Major comments from communities about air quality and public health protection around facilities
- Expectation is that emissions from well run facilities will not result in unhealthy levels of air pollution off site





# Residual Methane Offset Program

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- Recognize that this proposal is controversial
  - Looking for comments from all on this piece
  - Builds from MDE best practices proposal before fracking ban was finalized
  - Landfill methane capture as an example of an available offset (MD approved an offset project in 2017)
- Designed to provide major incentive to minimize leaking methane emissions - less fugitive emissions ... less offset costs
- Preference for methane offsets but reductions of other GHG emissions or other projects that are beneficial to local communities could be used
  - Linkage to RGGI and national and international offset markets
- MDE will maintain a list of potential offset opportunities that can be considered by the company
- Cost cap of 5-year average annual cost of no more than \$5000



# Community Meetings and Reporting

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- Facilities should work with local communities to establish meetings throughout each year



- Facilities will submit a comprehensive analysis of emission reductions achieved under the MEMP as required in new regulations
- MDE to monitor ... All parties expected to behave ... if not, MDE can waive community meeting provision



**PHASE 2 - ADDITIONAL  
METHANE SOURCES UNDER  
REVIEW**



# Other Potential Sources of Leaking Methane Emissions

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- Production/Fracking - In 2017, Maryland passed a law establishing a ban on hydraulic fracturing in the state
- MDE received significant comment and preliminary data pushing for making sure that methane emissions from existing wells and the distribution sector are minimized
- This effort on wells and the distribution sector will be the focus of phase 2 of this effort



# Distribution Sector

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Provides residential, commercial, and industrial customers with NG services

- Several Local Distribution Utility Companies (LDU) operate in Maryland
  - LDU connected to interstate pipelines via 7 primary interstate pipelines
  - 2014 Inventory estimates over 7,500 miles of pipeline
  - Approximately 600,000 services supplied
  - Natural gas is also stored underground to allow supplies to be held and released to meet times of peak demand

Suppliers participating in the distribution sector are licensed by the MD Public Service Commission (PSC) and comply with the law, and MD PSC regulations.



# Distribution Sector Challenges

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There is a significant amount of public concern over natural gas production and distribution

Moving forward, LDUs are being pushed by the public, regulatory agencies & often their internal policies to :

- Exhibit a high degree of environmental stewardship
- Maintain systems effectively and aggressively
- Effectively use advanced measurement and monitoring technology
- Minimize costs and reduce any increase in charges to the customers
- Meet all (not just air) regulatory requirements from local, state and federal agencies



# Distribution Sector - Potential Sources in Maryland

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- Pipeline Distribution
  - Baltimore Gas and Electric
  - Chesapeake Utilities Corporation
  - Columbia Gas
  - Easton Utilities
  - Elkton Gas
  - Eastern Shore Natural Gas
  - Penn Fuel Gas, Inc.
  - Washington Gas
  - UGI Utilities
- Natural Gas Storage (Peak Stations)
  - Baltimore Gas and Electric - Spring Gardens, Baltimore, MD
  - Washington Gas - Rockville Station, Rockville, MD
- In most cases, it appears that there are significant ongoing efforts to minimize leakage as leakage results in lower profits



# Distribution Sector

## *Aging Pipes*

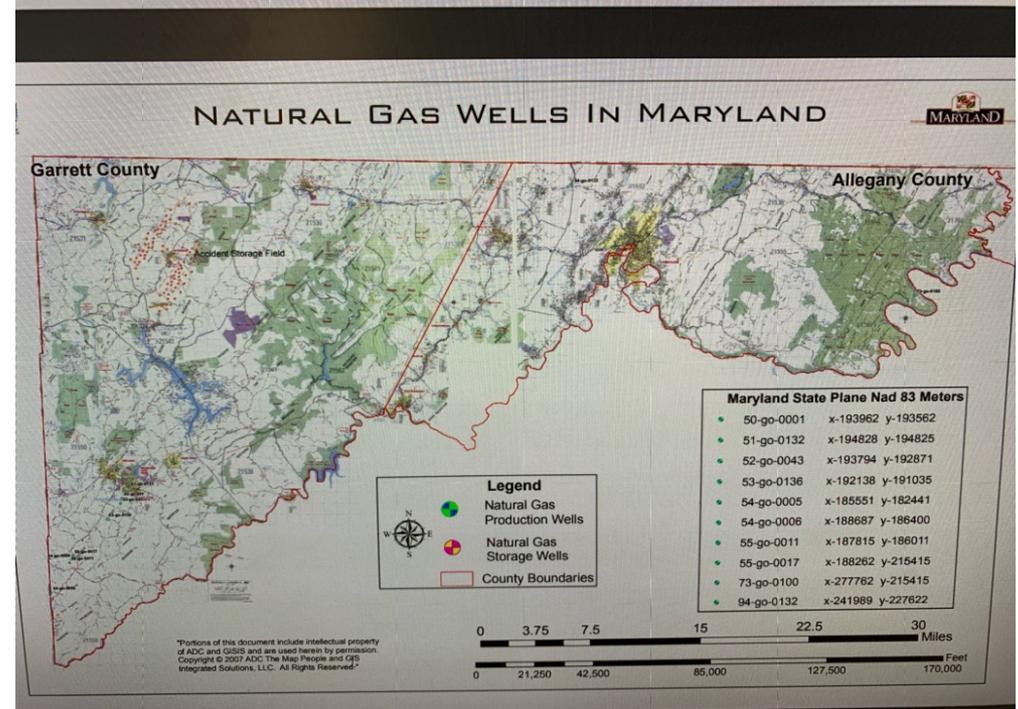
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- There is widespread consensus that aging cast iron and unprotected steel pipelines within older natural gas distribution systems are subject to more leakage
  - Older pipes ... More leaks
- To avoid leaking emissions, product loss, and for safety, industry best management practices include:
  - Replacement with plastic or protected steel
  - Flexible insert liners
  - Leak volume assessment
- The rate at which replacement is occurring differs significantly between suppliers



# Production/Existing Wells

- 10 active wells in western Maryland
- Permitted through MDE Land Mining program
- Storage wells at Texas Eastern regulated with Transmission sector
- Less than 1% of 2014 GHG Inventory



<https://mde.maryland.gov/programs/LAND/mining/Documents/www.mde.state.md.us/assets/document/mining/NaturalGasWellLocationMap.pdf>

A bright sun shining through a blue sky with white clouds. The sun is positioned in the upper right quadrant, casting rays across the sky. The clouds are scattered and vary in density, with some appearing as soft, white puffs and others as more defined, darker blue-grey shapes. The overall scene is bright and clear, suggesting a sunny day.

**HOW DO MARYLAND'S  
EFFORTS COMPARE TO OTHER  
LEADERSHIP STATES**



# Proposed MD Requirements Compared to Others

	MD - MEMP	EPA - 2016 NSPS OOOOa	CARB - Oil and Gas	CO – Regulation 7	NY – Oil and Gas Stakeholder Outline 11/8/2018
Applicability	Gathering and Processing, Transmission and Storage ... Distribution (Phase 2)	Production, Gathering and Processing, Transmission and Storage	Production, Gathering and Processing, Transmission and Storage	Production, Gathering and Processing	Production, Gathering and Processing, Transmission and Storage, Distribution
LDAR in Transmission and Storage	<p>Quarterly monitoring using OGI or Method 21.</p> <p>Repairs within 30 days of leak discovery</p>	<p>Quarterly monitoring using OGI or Method 21.</p> <p>Repairs within 30 days of leak discovery</p>	<p>Quarterly monitoring using Method 21. Frequency reduces based on leak %.</p> <p>Repairs within 30 days of leak discovery</p>	<p>Quarterly monitoring using OGI or Method 21.</p> <p>Repairs within 30 days of leak discovery</p>	<p>Quarterly monitoring using OGI or Method 21.</p> <p>Repairs within 5-30 days of leak discovery</p>



# Proposed MD Requirements Compared to Others - Continued

	MD - MEMP	EPA - 2016 NSPS OOOOa	CARB - Oil and Gas	CO – Regulation 7	NY – Oil and Gas Stakeholder Outline 11/8/2018
Pneumatic Controllers	<ul style="list-style-type: none"> <li>- Bleed rate &lt; 6 scfh</li> <li>- In 2022, switch to electric or compressed air or utilize vapor control</li> </ul>	<ul style="list-style-type: none"> <li>- Bleed rate &lt; 6 scfh</li> </ul>	<ul style="list-style-type: none"> <li>- Bleed rate &lt; 6 scfh</li> <li>- Switch to electric or compressed air or utilize vapor control</li> </ul>	<ul style="list-style-type: none"> <li>- Bleed rate &lt; 6 scfh; no-bleed where grid power (if placed in service on/after 5/1/2014)</li> </ul>	<ul style="list-style-type: none"> <li>- Bleed rate &lt; 6 scfh</li> </ul>
Recip engines rod replacement	Measure rod packing annually and replace at emission threshold or utilize vapor control	Every 3 years or 26,000, whichever is sooner	Measure rod packing annually and replace at emission threshold or utilize vapor control	Every 3 years or 26,000, whichever is sooner	Every 3 years or 26,000, whichever is sooner or utilize vapor control



# Proposed MD Requirements Compared to Others - Continued

	MD - MEMP	EPA - 2016 NSPS 0000a	CARB - Oil and Gas	CO – Regulation 7	NY – Oil and Gas (Under development) Stakeholder Outline 11/8/2018
Blowdown events at compressor stations	Report to State	No requirement	No requirement	No requirement	Use inline pipeline compressors to reduce the pressure where technically feasible
Distribution sources	Under further review	No requirement	No requirement	No requirement	Investigating LDAR at metering and regulating stations.



# Schedule

- Begin to work with affected sources on concepts in the MEMP ... Now
- Summer - Draft Regulations and final stakeholder meeting
- Fall - Advisory Council and Proposal in Maryland Register
- Late 2019/Early 2020 - Final adoption





# Other Methane Issues of Potential Interest

- Maryland is working with approximately 15 other states to challenge backsliding on federal methane reduction rules for new and existing sources in the oil and gas sector
- Same for federal landfill rules
- Maryland is also working on understanding the life-cycle of emission changes associated with natural gas
  - Looking at in-state and upstream sources



A bright sun is shining in the upper right corner of a clear blue sky, creating a lens flare effect. The sun is partially obscured by a layer of white, fluffy clouds that stretch across the middle of the frame. The sky transitions from a deep blue at the top to a lighter blue at the bottom.

**QUESTIONS?  
DISCUSSION**