U.S. DEPARTMENT OF ENERGY
Fossil Energy and Carbon Management

University of Pittsburgh Infrastructure Sensing Collaboration Workshop 2024

National, State, and Regional Perspectives on Infrastructure Sensing

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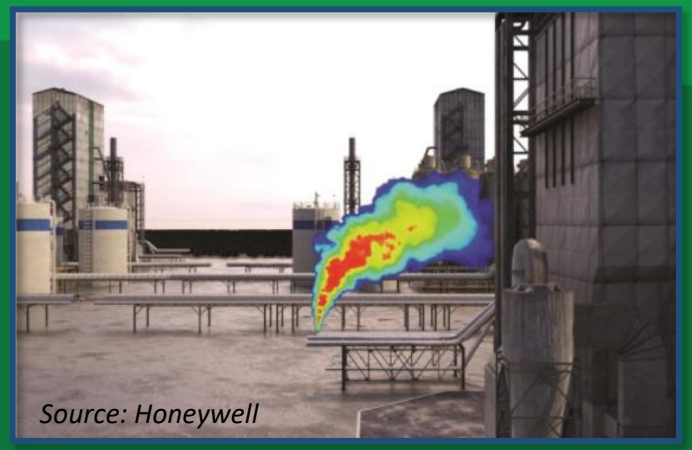
Source: Honeywell


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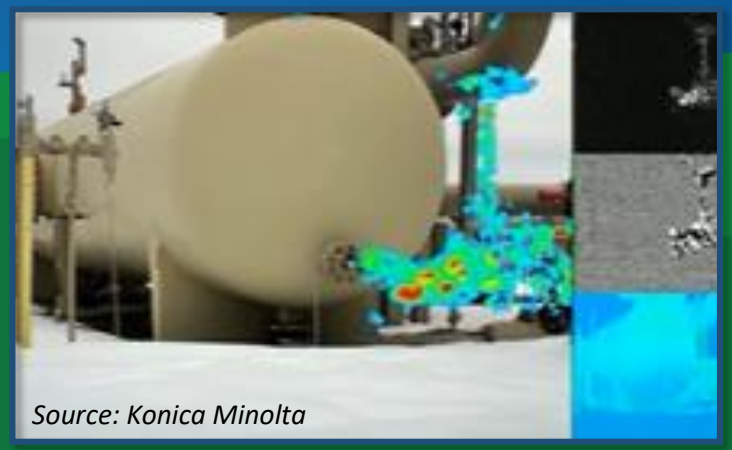
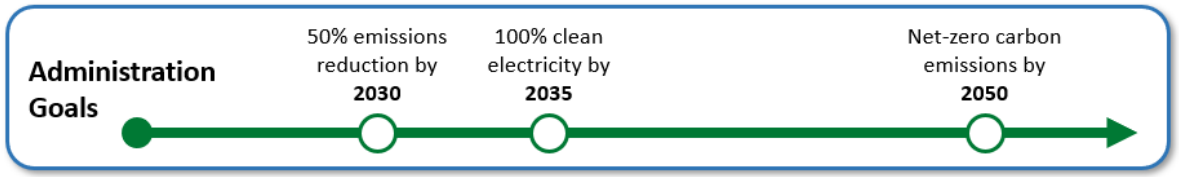
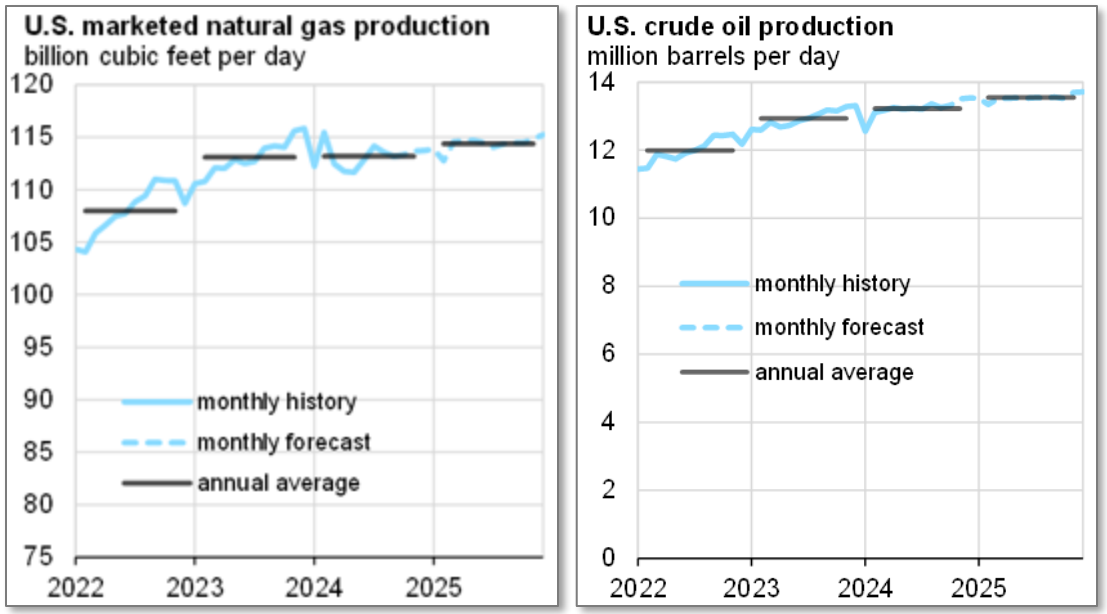

Source: Konica Minolta

Program Mission

Administration's Goals



Oil & Natural Gas Production

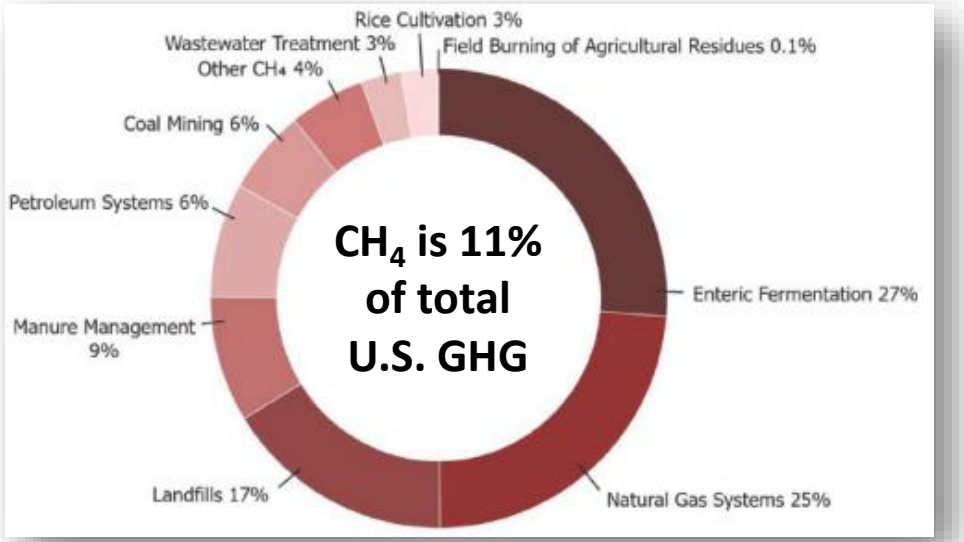


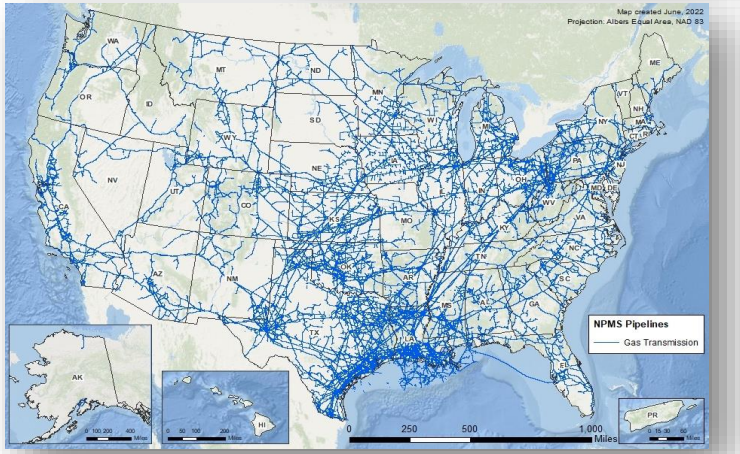
- US natural gas production expected to reach more **114 billion cubic feet** per day in 2025.
- US crude oil production expected to reach more than **13 million barrels** per day in 2025.
- Increased domestic production of oil and natural gas promotes **energy security**.
  - Exports of oil and natural gas are directly related to domestic production.
  - Petroleum & hydrocarbon-based products supply is directly related to domestic production.

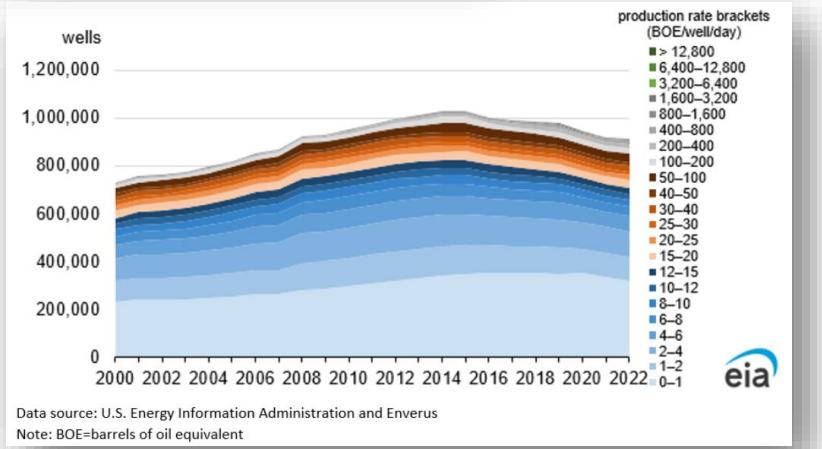
EIA Short Term Energy Outlook

Challenges to GHG Reduction Component

- Petroleum & natural gas systems are **~30% of the "methane issue"**
- More than **2.6 million miles of pipelines**, including more than **400,000 miles of transmission and gathering pipelines**, and **2.2 million miles of distribution pipelines (main and service)**.
- Over **900,000 operating wells** and an estimated **2-3 million abandoned wells** (including between **300,000 and 800,000 orphaned wells**)
- Tens of thousands of "unit operations", including compressors, gathering/boosting systems, storage, and processing facilities
- 17 oil and natural gas producing basins with **nearly 60,000 operating companies**







Reducing methane emissions across the oil & natural gas industry

Methane Emissions Quantification

Direct and remote measurement sensor technologies and collection of data, research, and analytics that quantify methane emissions from point sources along the upstream and midstream portion of the natural gas value chain

Natural Gas Decarbonization and Hydrogen Technologies

Technologies for clean hydrogen production, safe and efficient distribution, and geologic storage technologies supported by analytical tools and models

Methane Emissions Mitigation

Advanced materials, data management tools, inspection and repair technologies, and dynamic compressor R&D for eliminating fugitive methane emissions across the natural gas value chain

Methane Emissions Reduction Program

Under the IRA, MERP will help oil and natural gas sector operators cut methane emissions and transition to innovative methane emissions reduction technologies.

Undocumented Orphaned Wells

Developing tools, technologies, and processes to efficiently identify and characterize undocumented orphaned wells in order to prioritize them for plugging and abandonment.

Waste and Underutilized Natural Gas Conversion

Technologies for conversion and utilization of natural gas to reduce venting and flaring of the resource

Methane Monitoring Technology Development Drivers

Corporate Targets

- Safety, Efficiency, $$$
- Corporate Environmental, Social, Governance requirements.
- Potential "Certified" natural gas requirements (e.g. MiQ)

CALIFORNIA AIR RESOURCES BOARD

COLORADO Department of Public Health & Environment

Adoption of State Regulations

- California adopted regulation in 2017
  - Equipment emissions standards and LDAR*
  - Proposing emissions measurement and accounting
- Colorado requirement to measure and quantify emissions intensity in 2023

LDAR: Leak detection and repair

EPA

Final 2024 Methane Rule

- Finalized New Source Performance Standards (NSPS) to reduce methane and VOCs across the O&G Industry
- Requires LDAR program implementation across assets
- Revised Greenhouse Gas Reporting Program (GHGRP)—new "empirical" data
- Super-emitter reporting program

UN environment programme

International Efforts

- UNEP established International Methane Emissions Observatory (IMEO)
- Comprehensive, measurement-based reporting framework
- Global Methane Alert and Response System (MARS)
- OGMP: Oil and Gas Methane Partnership

Federal Methane Monitoring Regulations

Greenhouse Gas Reporting Program (GHGRP)

- Facilities are required to report their annual emissions if more than **25,000 metric tons CO_2e**
- **Flexibility to employ "Advanced Monitoring Technologies" to monitor and report for leaks.**

Alternative Technology Periodic Screening Frequency

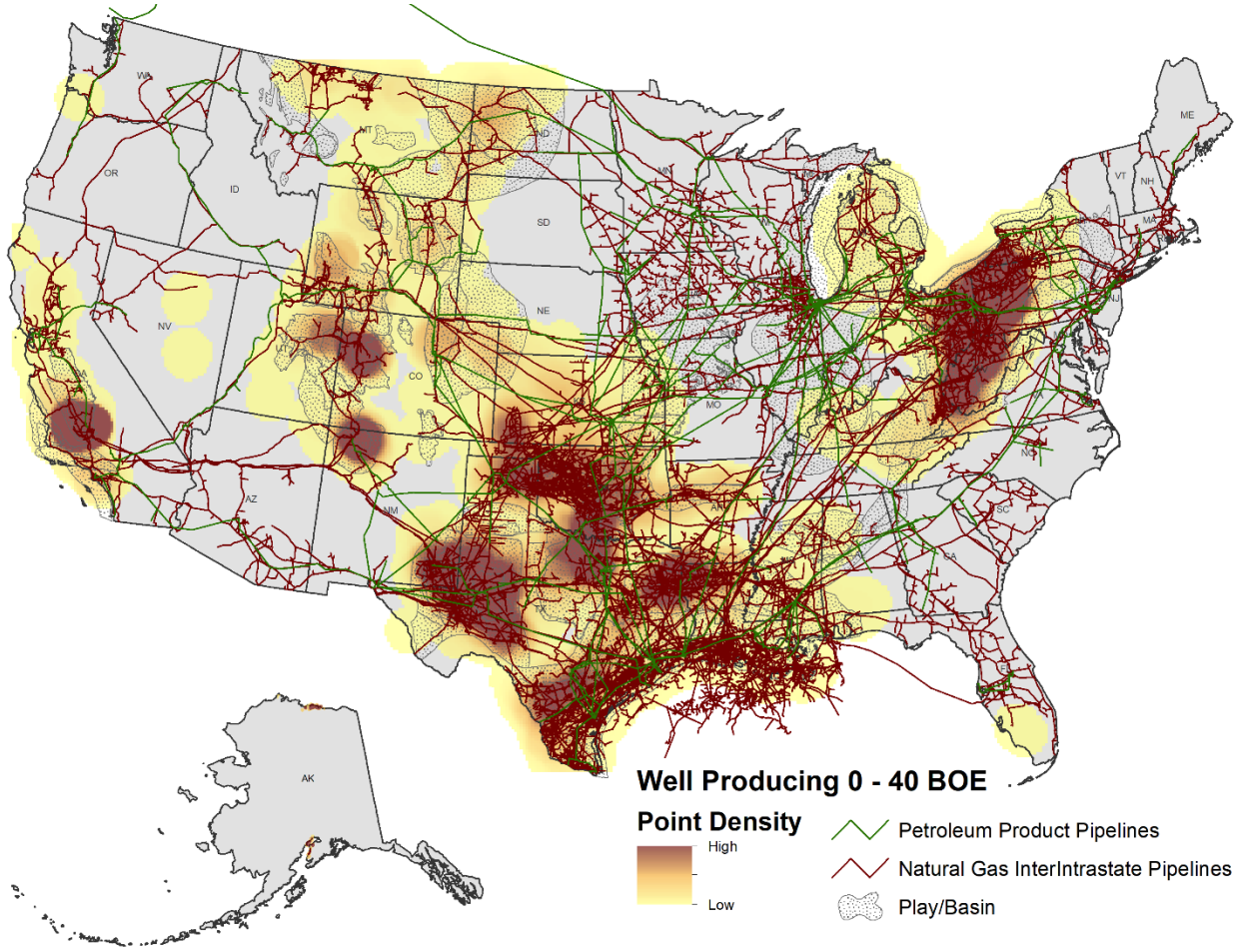
Well Sites, Centralized Production Facilities, & Compressor Stations

Minimum Screening Frequency	Minimum Detection Threshold of Screening Technology
Quarterly	≤1 kg/hr*
Bimonthly	≤2 kg/hr
Bimonthly + OGI	≤10 kg/hr
Monthly	≤5 kg/hr
Monthly + OGI	≤15 kg/hr

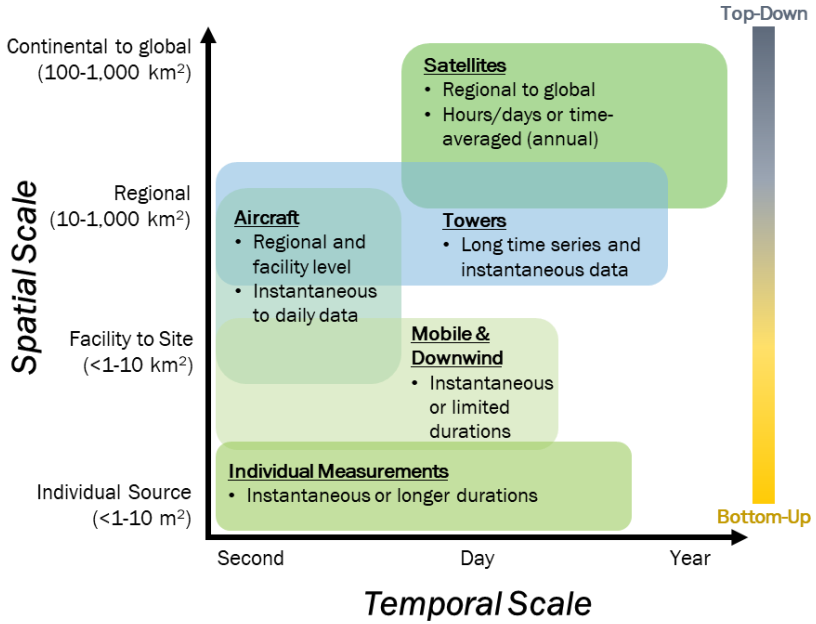
*3 kg/hr for a period of 2-years from effective date of the rule

***Probability of Detection at 90%**

Infrastructure Monitoring Challenges



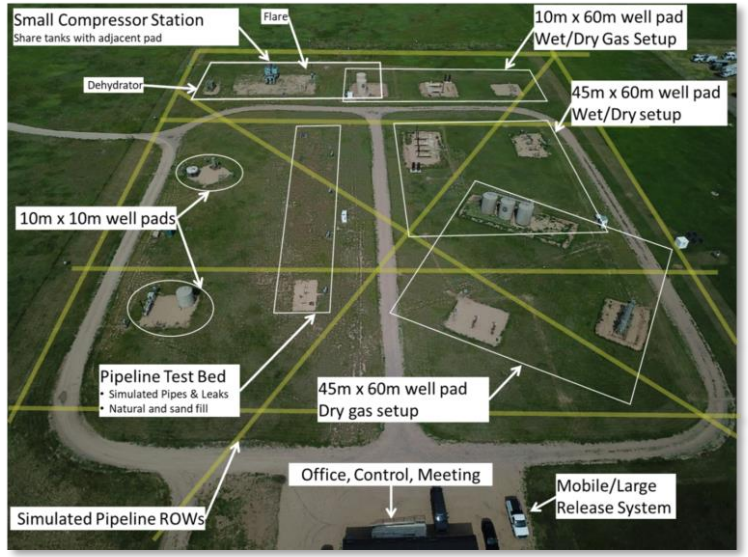
- Oil & gas infrastructure density
- Legacy assets
- Non O&G sector emissions
- Large uncertainty remaining with today's detection and quantification technologies



Advanced O&G Industry Sensor Research Projects

Developing and validating the performance of new technologies that are intended to more accurately and precisely measure emissions occurring across the natural gas supply chain.

- **Develop innovative methane sensor technologies** (e.g. fiberoptic, electrochemical) to enable low-cost, accurate, continuous CH_4 monitoring and risk assessment
- **Validate the performance of existing and new technologies** that are intended to more accurately and precisely measure emissions occurring within the natural gas supply chain (METEC)
- Improve and accelerate adoption of **methane emission detection and measurement technology on a wide scale** by supporting large-scale field demonstrations (Methane Monitoring Networks)
- Engaging in **field efforts to characterize emissions** from a variety of sources related to natural gas production, transport, and storage to better inform industry and regulators:
  - Basin-scale Assessments (5 projects)
  - Orphaned wells
  - Marginal wells
  - Gathering pipelines
  - Compressor stations
  - Tanks



Thank you

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Office of Fossil Energy and Carbon Management| Office of Resource Sustainability