Utility Use of Advanced Leak Detection to Maximize Cost Effective Methane Reductions

New Jersey Clean Air Council

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Finding the ways that work

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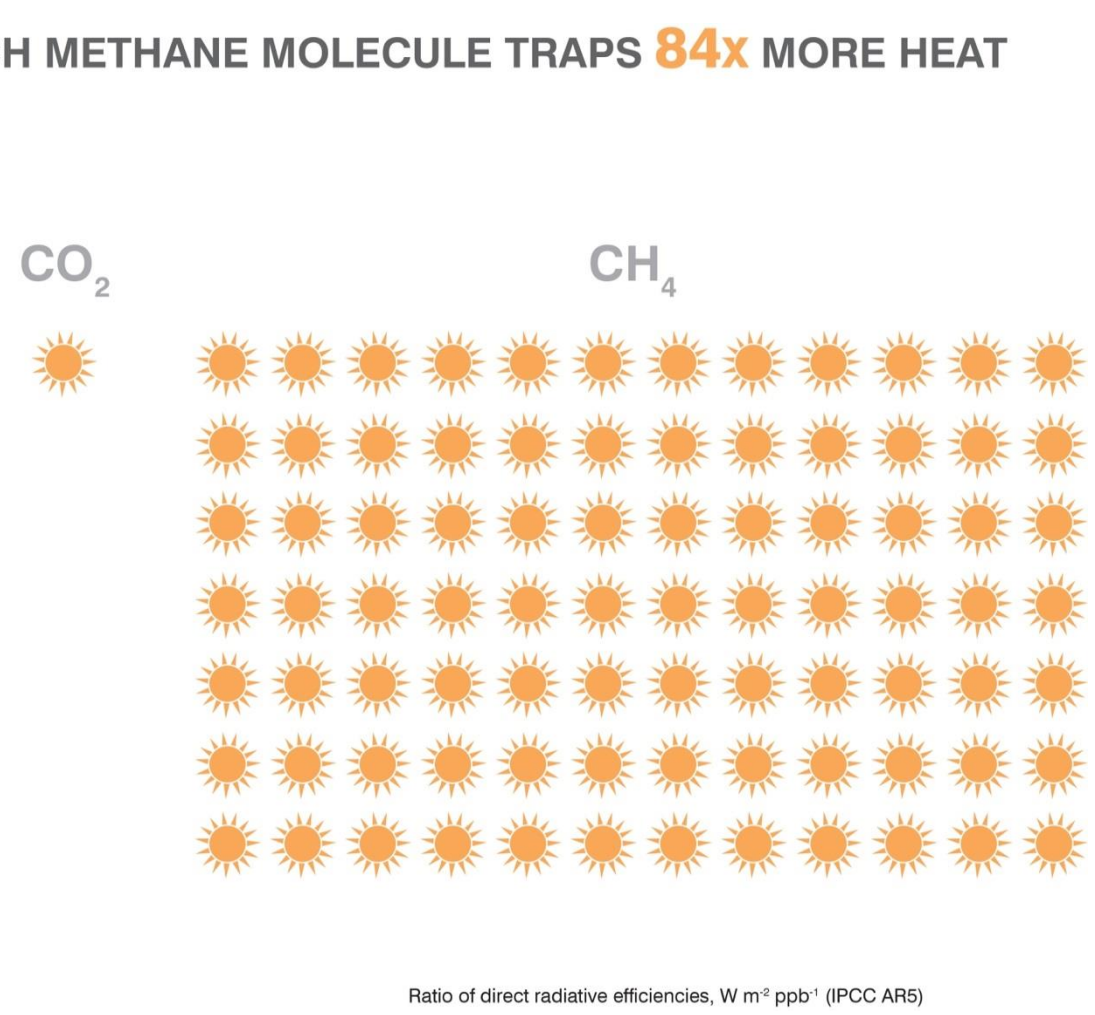
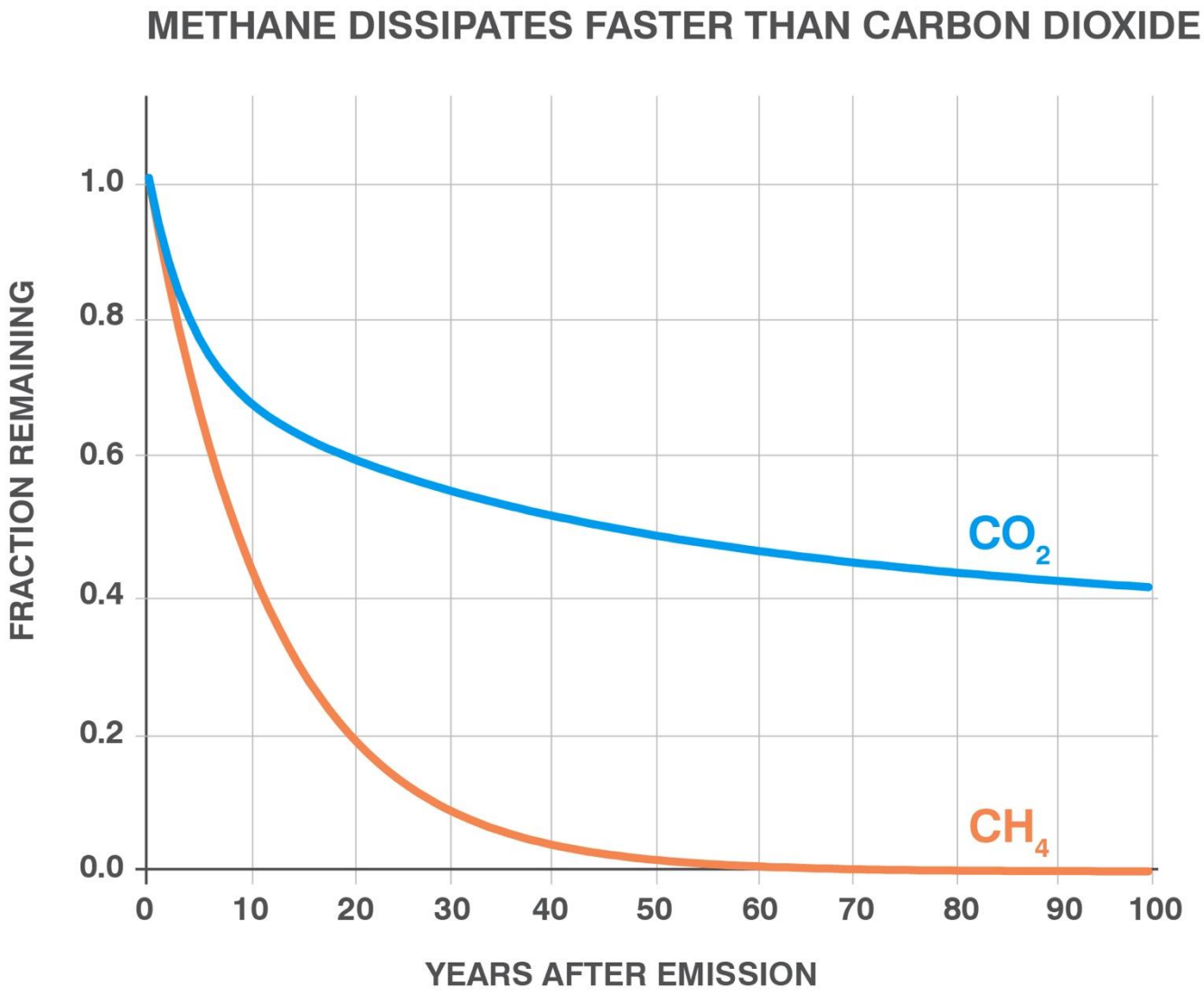
CH_4 traps more heat than CO_2...

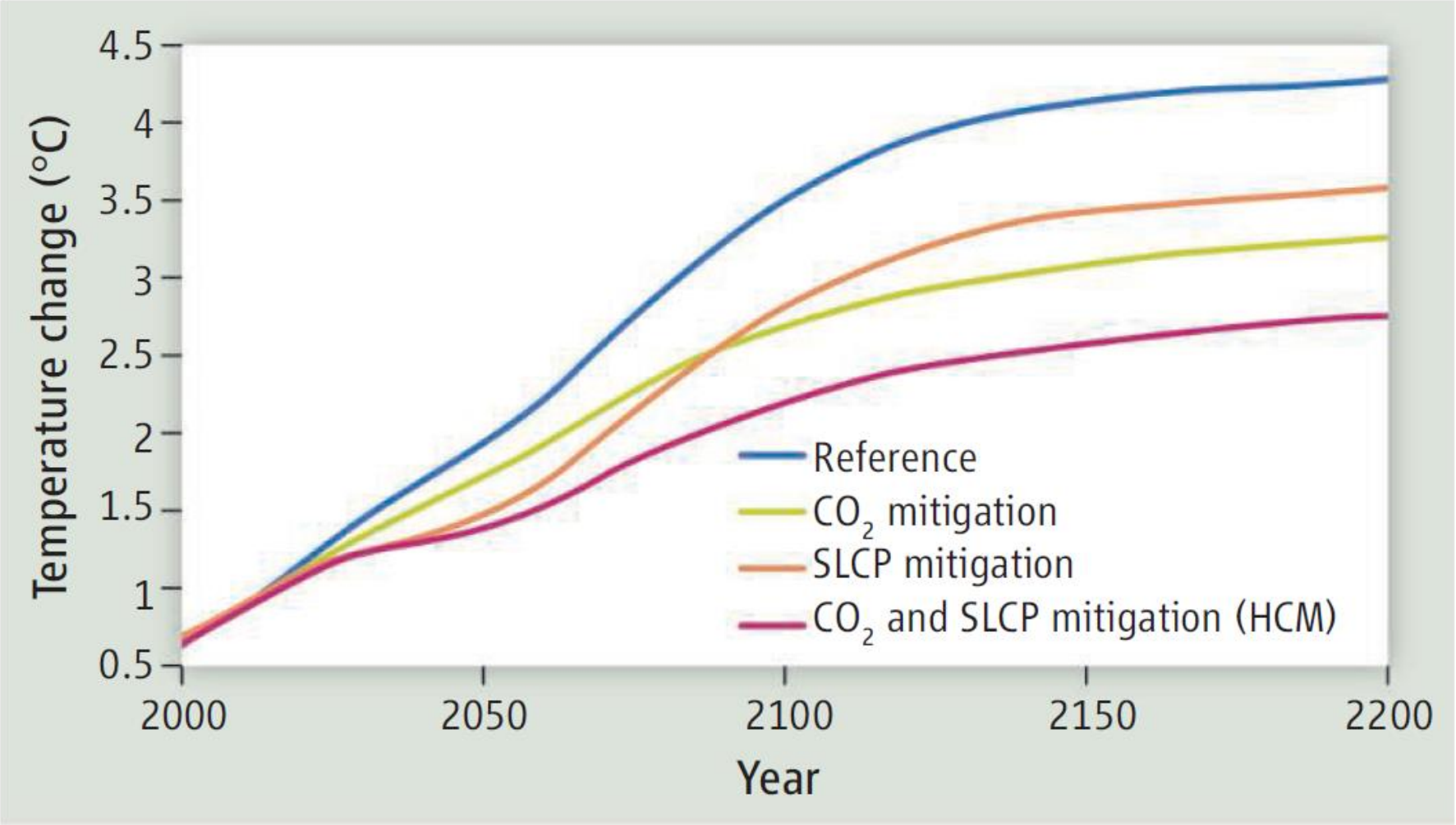


…but breaks down faster than CO_2



- CH_4 produces tropospheric ozone and stratospheric water vapor as it decays
- Increases the direct warming effect by 65% (IPCC AR5)

Methane *and* CO_2 reductions required



Shoemaker, et. al., **What Role for Short-Lived Climate Pollutants in Mitigation Policy?,** Science, December 19, 2013

Large Number of Methane Leaks from Aging Urban Infrastructure

State	Miles of Leak-Prone Pipe	% of U.S. Leak-Prone Pipe
NY	16,442	17%
TX	10,652	11%
PA	10,313	11%
OH	10,282	11%
CA	8,358	9%
NJ	6,368	7%

PHMSA 2016 Data

New Jersey utilities have more cast iron distribution pipelines than any other state, 3911 miles as of 2019.

Nationally, **10.6 percent** of the safety incidents occurring on gas distribution mains involved cast iron mains. However, less than **2 percent** of distribution mains are cast iron.

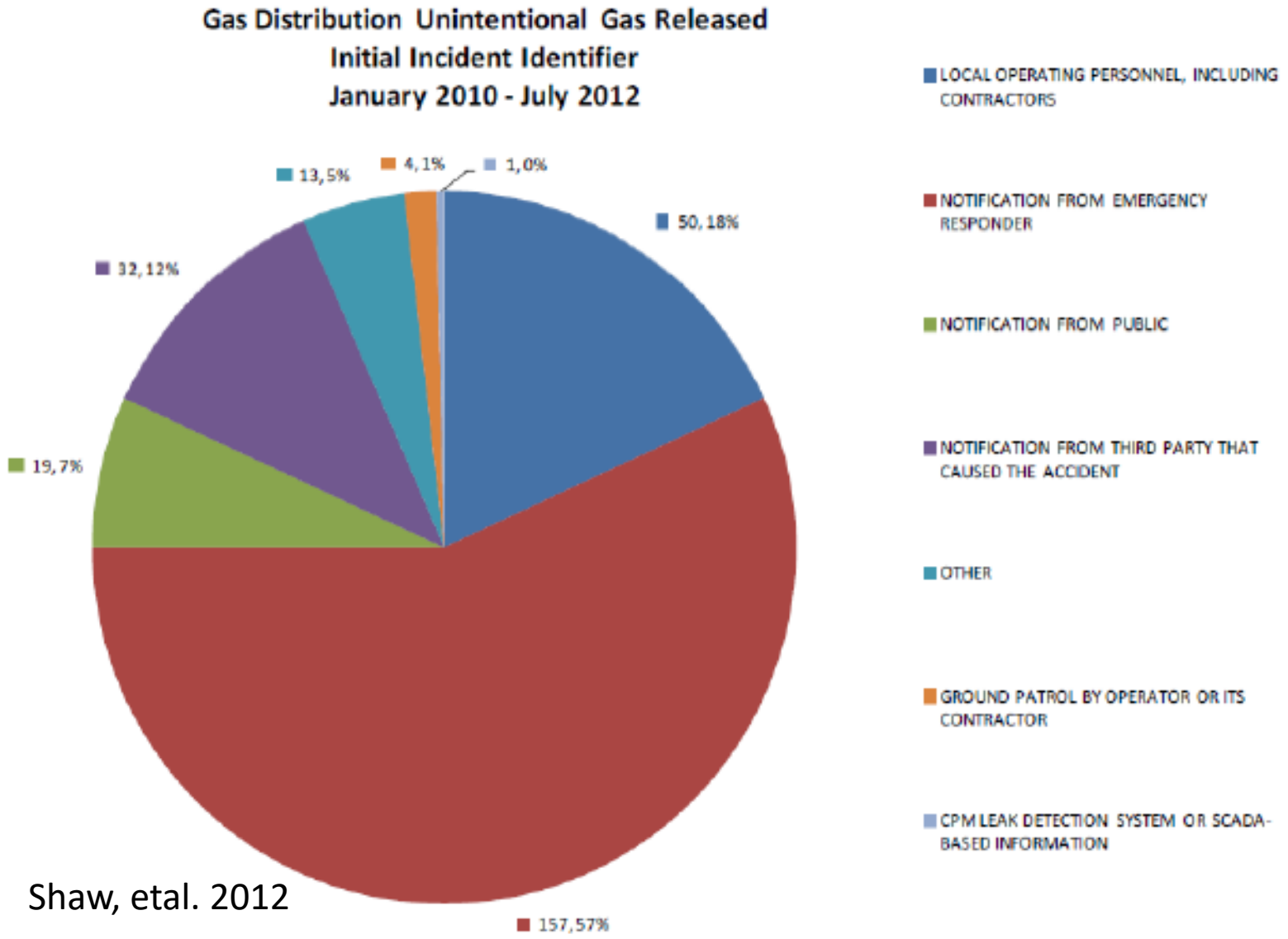
New Jersey Methane Emissions

- Local distribution companies (LDCs) are responsible for 850,912 metric tons, or 40.3% of NJ methane emissions.
- Self-reported data from New Jersey's four LDCs (Elizabethtown Gas, NJ Resources, PSE&G and South Jersey gas) reveal that 79% of their emissions come from leaks in their distribution system gas mains.
- Thus, the EPA data indicate that 32% of New Jersey's CH4 emissions come from leaks in the mains that distribute natural gas to homes and businesses.

How Utilities Find Leaks, Before:

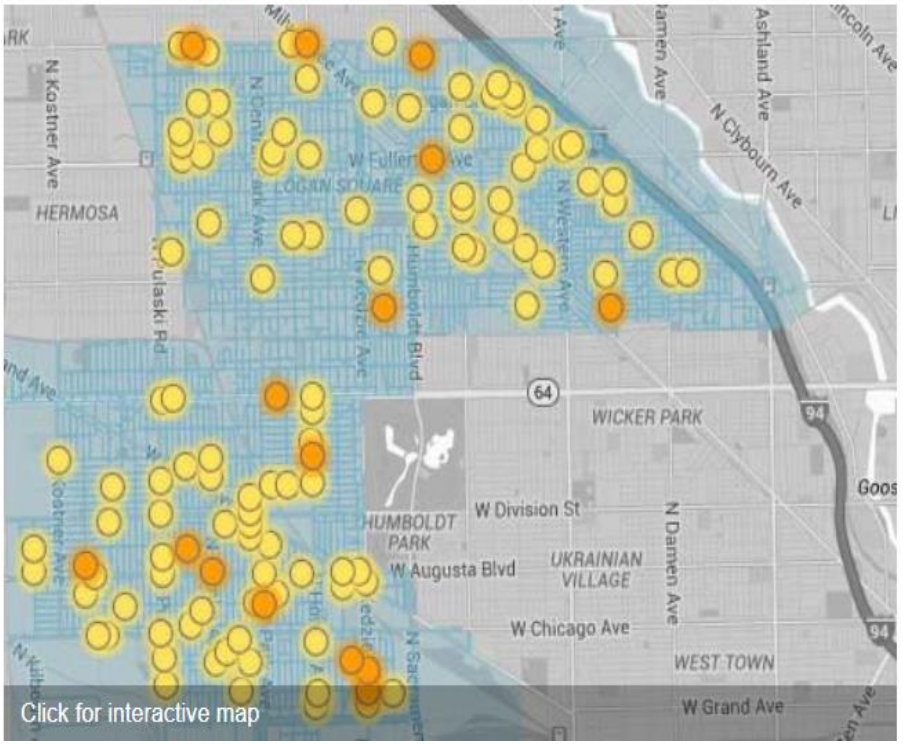
- The “state of the art” is handheld methane detectors DIMP surveys or responding to odor calls.
- The vast majority of leaks are found by first responders or customers smelling gas.
- Is there a better way?

2012: First Responders Find Most Leaks



Shaw, etal. 2012

EDF/Google Leak Mapping Project



What began as an EDF science and methane public awareness campaign in 2014 is shaping gas utility business practices in 2019.

ALD+ = Sensors and data analytics

High sensitivity, mobile Mounted methane detectors

Available to utilities via Picarro, Heath/LGR

Faster, more sensitive than optical imaging or hand held flame ionization

Can quantify leak flow volume

Source: Picarro

Validation of false positives & leak size estimation

Weller *et al.*

EnvSci&Tech 2018

ENVIRONMENTAL Science & Technology

Vehicle-Based Methane Surveys for Finding Natural Gas Leaks and Estimating Their Size: Validation and Uncertainty

ALD finds leaks that other methods miss: PG&E, Centerpoint Energy, CSU analysis finds 3 to 5 times more leaks than standard utility survey methods

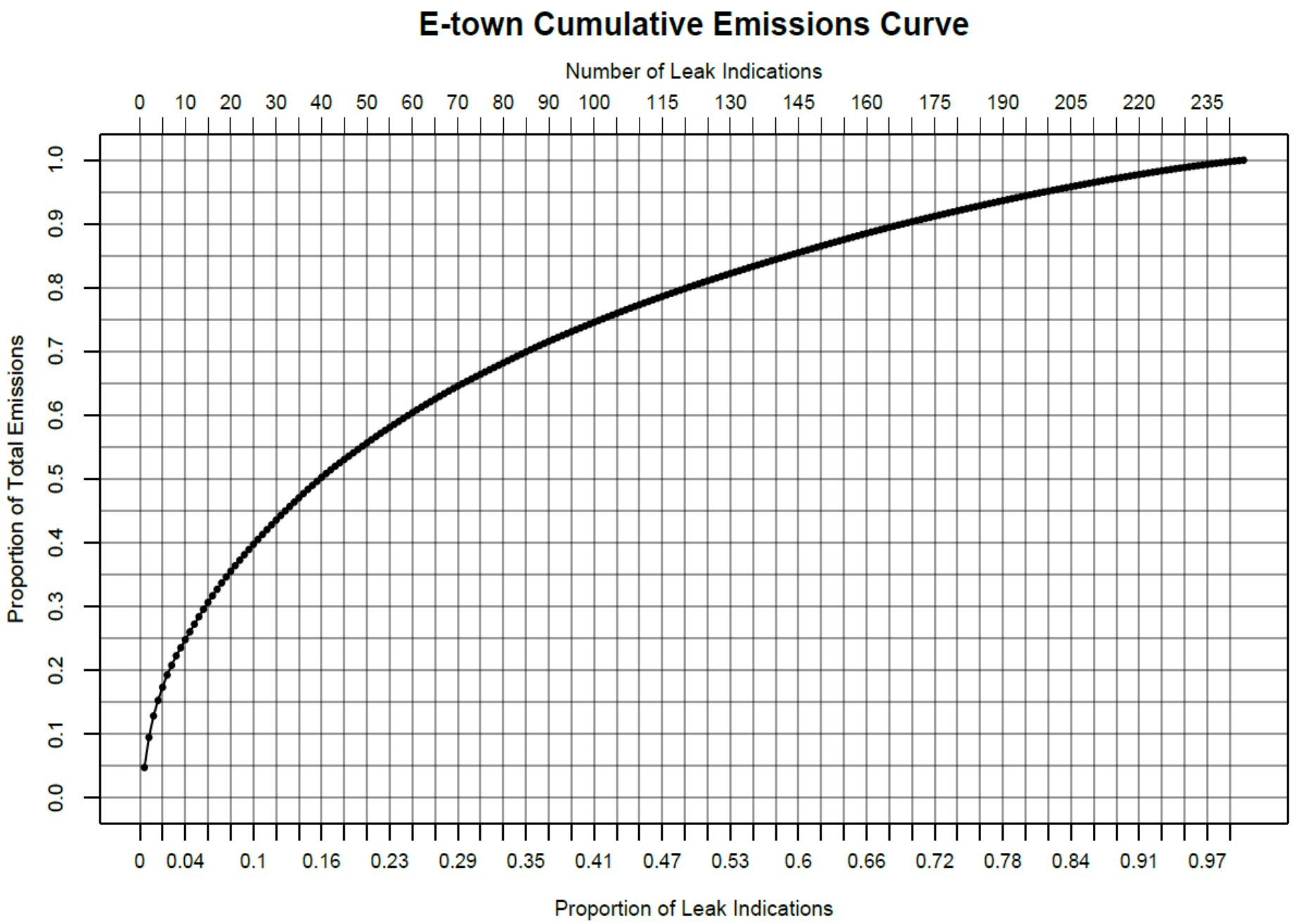
Prioritizing Pipe Replacement Using ALD+

- Public Utilities Fortnightly white paper and article (May 2017) describe methodology and benefits.
- Improving decision-making by using ALD+.
- EDF collaborations with PSE&G (NJ), PGL (Chicago), Con Ed (NY), PG&E (CA) and Peoples (Pittsburgh)

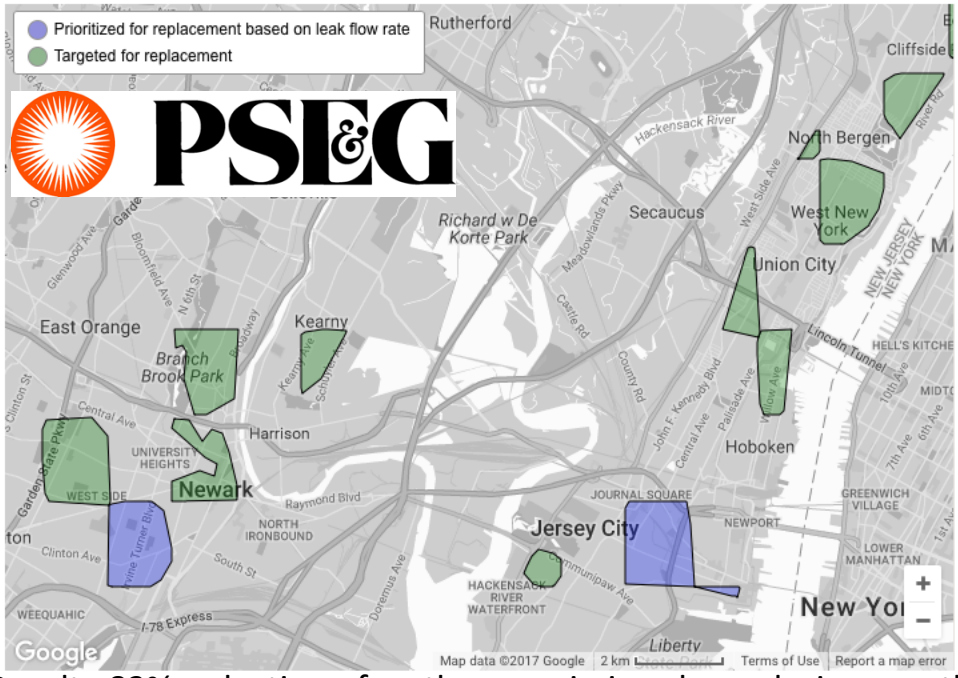
Leak Detection/ Measurement Saves Money

Market Based Solutions

BY VIRGINIA PALACIOS


E-town Cumulative Emissions Curve
Number of Leak Indications
0 10 20 30 40 50 60 70 80 90 100 115 130 145 160 175 190 205 220 235
Proportion of Total Emissions
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
0 0.04 0.1 0.16 0.23 0.29 0.35 0.41 0.47 0.53 0.6 0.66 0.72 0.78 0.84 0.91 0.97
Proportion of Leak Indications

PSE&G: ALD+ methods helped prioritize $900M in pipeline replacement



Result: 83% reduction of methane emissions by replacing one-third fewer miles of gas lines than under a business as usual scenario.

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in Support of the Methane Leak Surveying Report for the PSE&G GSMP II Program

Prepared by Picarro, Inc.

December 14, 2018

roduction

arro has completed mobile methane emissions measurements for use in the r
ase of PSE&G's Gas System Modernization Program (GSMP II). Methane data w
hered along approximately 280 miles of Utilization Pressure Cast Iron ("UPCI
mains contained in 44 map grids. The replacement of mains within GSMP II w
ow the prioritization based on the grid-based Leak Hazard Indices developed
E&G, and the Picarro methane emissions results will be used as a sub-
oritization metric within that framework. Including methane emission rate
lumetric flow rate) as part of the replacement prioritization process may resu
he reduction of natural gas emissions and reduce the environmental impacts
h emissions. This document describes the measurement campaign results, da

PSEG Findings:

With methane maps and their aggregated emissions data, however, it is possible to make accurate, surgical construction decisions at the grid or individual pipeline section level as desired.

Although the total grid emissions trends essentially with the per-mile emission rate, there are exceptions to that trend, also evidenced by visual comparison of the methane maps – there are large variations in both per-mile leak density as well as variability of over two orders of magnitude in leak rates.

This variability shows the power of the methane mapping technique for providing additional granularity that can be used to maximize methane emissions reductions and/or maximize remediation of the maximum number of belowground leaks through changes to construction priorities based on these methane maps and associated data.

Today's Best Practice: Emissions Quantification & Leak Density Estimation Analytics

- Mobile mounted high sensitivity leak detectors find and quantify leaks
- Using methane data, analytics estimate leak density and measure emissions of pipe segments rather than identifying individual leaks
- Pipe segments with highest leak density are identified for repair or capital replacement
- Emissions, costs and safety risk are reduced

Source: Picarro

Finding and Recommendations

- Advanced leak detection methods would reduce more than 50% of methane emissions by repairing only the largest 20% of leaks.
- Recommendations
  - Require use of ALD to establish inventory
  - Mandate abatement of environmentally significant non-hazardous leaks (by leak flow volume)
  - Track emissions
  - Partner with BPU to address LDC costs and incentives