New and Future Developments in Methane Policy and Technology

Presented to:

CMS Applications Policy Speaker Series

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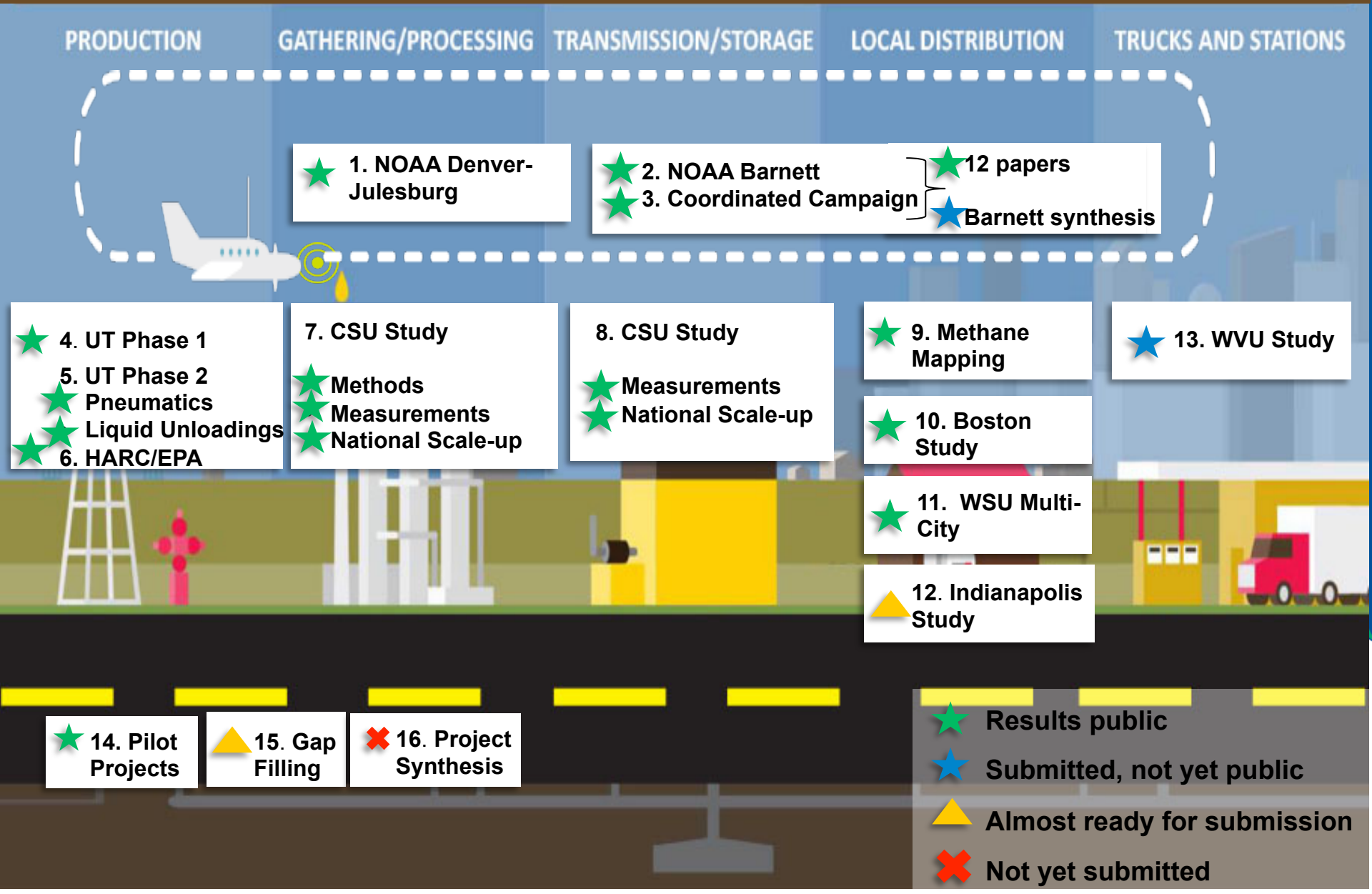
EDF
ENVIRONMENTAL DEFENSE FUND®
Finding the ways that work

Methane Science

What have we done and learned?

EDF STUDIES BY SUPPLY CHAIN SEGMENT

(roughly 30 total papers)



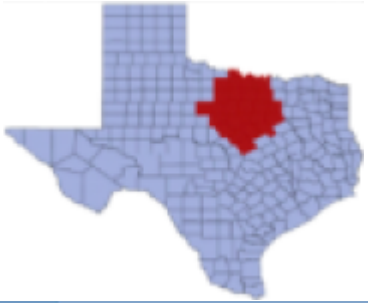
24 published studies so far

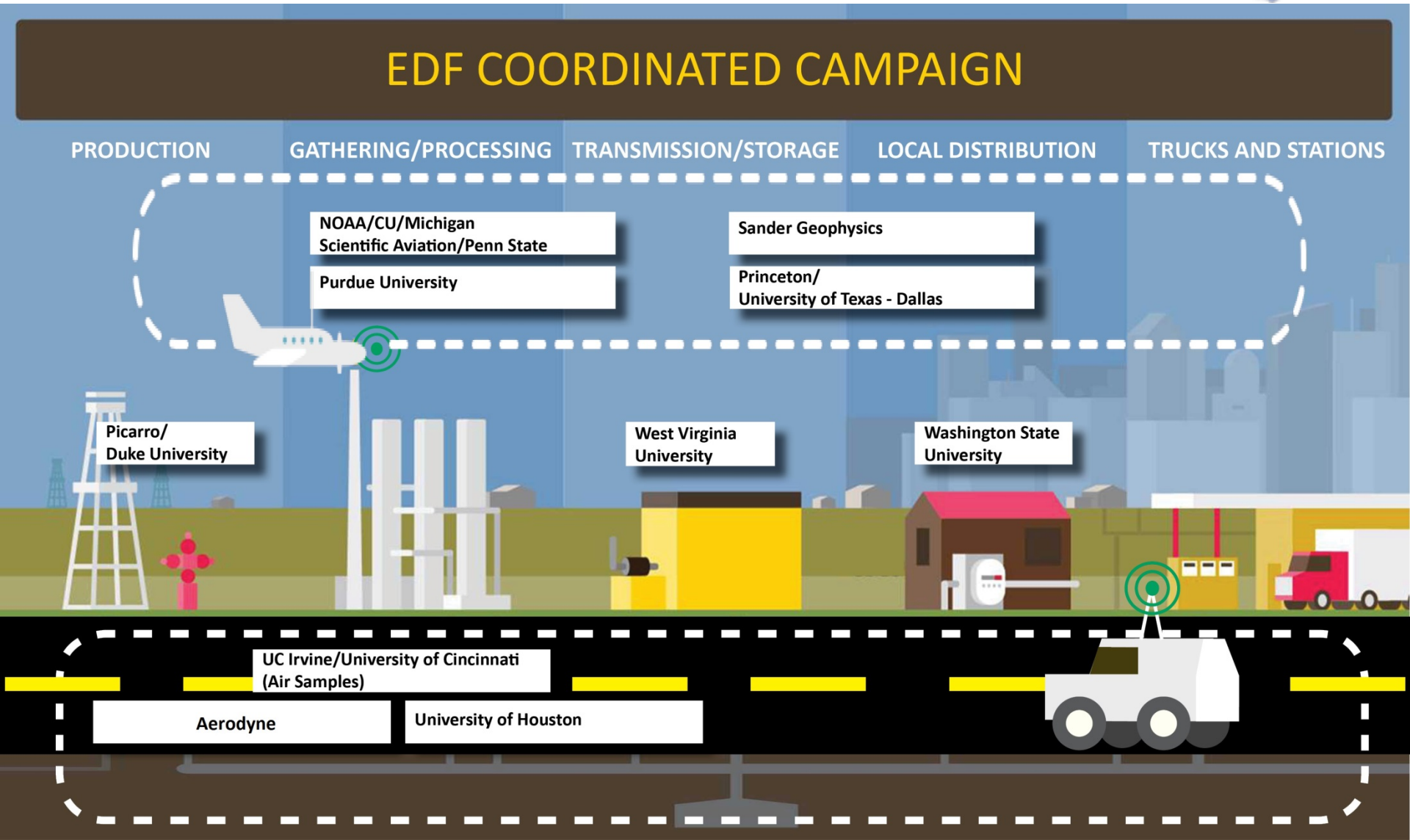
1. **December 2013:** UT Production study: http://www.pnas.org/lookup/doi/10.1073/pnas.1304880110
2. **May 2014**: NOAA DJ Basin Flyover: http://onlinelibrary.wiley.com/doi/10.1002/2013JD021272/pdf
3. **November 2014:** HARC/EPA Fence-line study: http://pubs.acs.org/doi/abs/10.1021/es503070q
4. **December 2014** UT Pneumatics Study: http://pubs.acs.org/doi/abs/10.1021/es5040156
5. **December 2014** UT Liquid Unloadings Study: http://pubs.acs.org/doi/abs/10.1021/es504016r
6. **January 2015:** Harvard Boston Urban Methane Study: http://www.pnas.org/content/early/2015/01/21/1416261112
7. **February 2015:** CSU Transmission and Storage study: Measurement paper: http://pubs.acs.org/doi/abs/10.1021/es5060258
8. **February 2015:** CSU Gathering and Processing study: Measurement paper: http://pubs.acs.org/doi/abs/10.1021/es5052809
9. **March 2015:** WSU Local Distribution study: http://pubs.acs.org/doi/abs/10.1021/es505116p
10. **May 2015:** CSU Gathering and Processing study, Methods paper: http://www.atmos-meas-tech.net/8/2017/2015/amt-8-2017-2015.html
11. **July 2015**: CSU Transmission and Storage study National results paper: http://pubs.acs.org/doi/abs/10.1021/acs.est.5b01669
12. **August 2015:** CSU Gathering and Processing study CSU Gathering and Processing study National results paper: http://pubs.acs.org/doi/abs/10.1021/acs.est.5b02275

Barnett Coordinated Campaign Papers (July 2015)

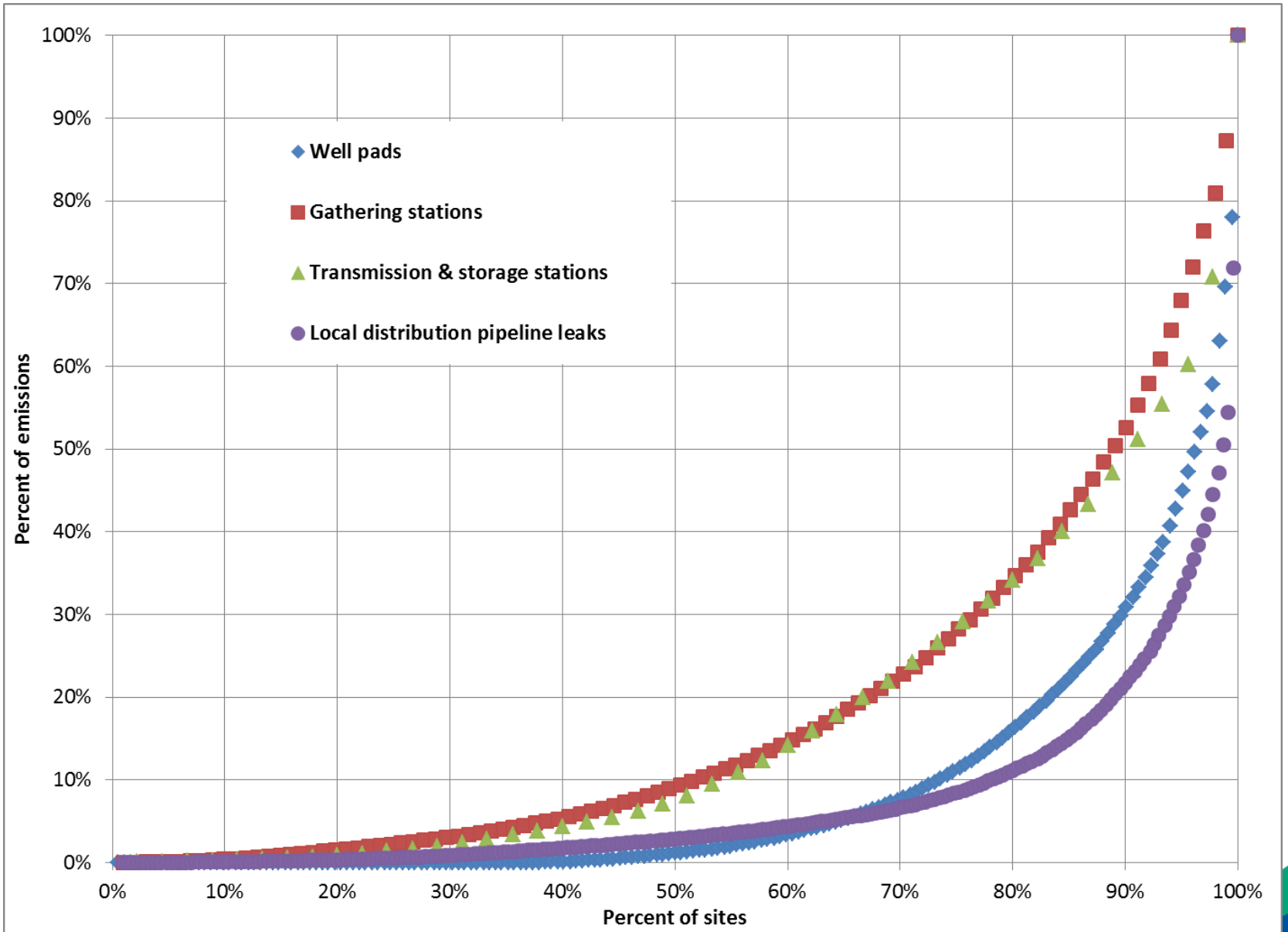
13. **Overview:** http://pubs.acs.org/doi/abs/10.1021/acs.est.5b02305
14. **NOAA led Top-down study**: http://pubs.acs.org/doi/abs/10.1021/acs.est.5b00217
15. **Bottom-up inventory - EDF**: http://pubs.acs.org/doi/abs/10.1021/es506359c
16. **Functional super-emitter study - EDF:** http://pubs.acs.org/doi/abs/10.1021/acs.est.5b00133
17. **Michigan airborne study:** http://pubs.acs.org/doi/abs/10.1021/acs.est.5b00219
18. **WVU compressor study:** http://pubs.acs.org/doi/abs/10.1021/es506163m
19. **Princeton near-field study**: http://pubs.acs.org/doi/abs/10.1021/acs.est.5b00705
20. **Purdue aircraft study:** http://pubs.acs.org/doi/abs/10.1021/acs.est.5b00410
21. **Aerodyne mobile study:** http://pubs.acs.org/doi/abs/10.1021/es506352j
22. **U of Houston mobile study:** http://pubs.acs.org/doi/abs/10.1021/es5063055
23. **Picarro mobile flux study**: http://pubs.acs.org/doi/abs/10.1021/acs.est.5b00099
24. **Cincinnati tracer apportionment:** http://pubs.acs.org/doi/abs/10.1021/acs.est.5b00057

Barnett Shale
October 16 – 30, 2013





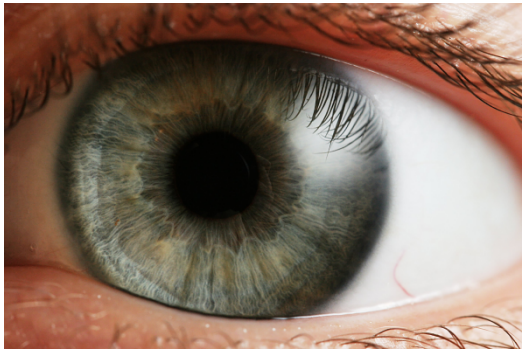
A small fraction of sites and components contributes the majority of emissions



Methane Detection Technologies & Strategies

Where are we headed?

Today’s approach to leak detection



Cut cost, shift paradigm

Methane Leakage Detector

Methane Detectors Challenge – Innovation[2]

Demand
Buy and Use

SWN Southwestern Energy®

HESS

Shell

Apache

Anadarko Petroleum Corporation

noble energy

BG GROUP

Statoil

Market Maker
Convene and Catalyze

EDF ENVIRONMENTAL DEFENSE FUND™
Finding the ways that work

Supply
Innovate

- Colorado start-up
- Colorado academic
- Chinese coal mine safety co.
- Swedish sensor co.

Advise

SwRI®

NETL NATIONAL ENERGY TECHNOLOGY LABORATORY

HARVARD UNIVERSITY

CLEANAIR TASK FORCE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

…and more…

Desired specifications for detection tech

Table 1: Specifications desired in each phase of the challenge			
Specification	**First Round Lab Test**	**Second Round Lab/Field Test**	**Industry Pilot Purchase/Deployment**
Detection limits	5 ppm*	5 ppm*	2 ppm*
Detection range	5 ppm - 250 ppm*	5 ppm - 250 ppm*	2 ppm - 2000 ppm*
Leak detection capability	Not specified	5 scfm	2.5 scfm
Calibration frequency	1-2 times or less per test phase	1-2 times or less per test phase	Once per year or less
Remote calibration	Optional	Optional	Preferred
Ability to measure methane	Required	Required	Required
Ability to measure other hydrocarbons	Optional	Optional	Optional
Methane specific detection	Optional	Optional	Preferred
Ability to isolate on-site methane gas from off-site sources	Optional	Required	Required
Power requirements	110v, 20 amp or single size solar panele and rechargeable battery	Single, standard size solar panel and rechargeable battery	Single, standard size solar panel and rechargeable battery
Power consumption	As low as possible	As low as possible	As low as possible
Cost of hardware	Not specified	Not specified	$5000/$1000 per unit**

SOURCE: Methane Detectors Challenge, Request for Proposal, 2014 (table excerpted in part)

Preliminary results

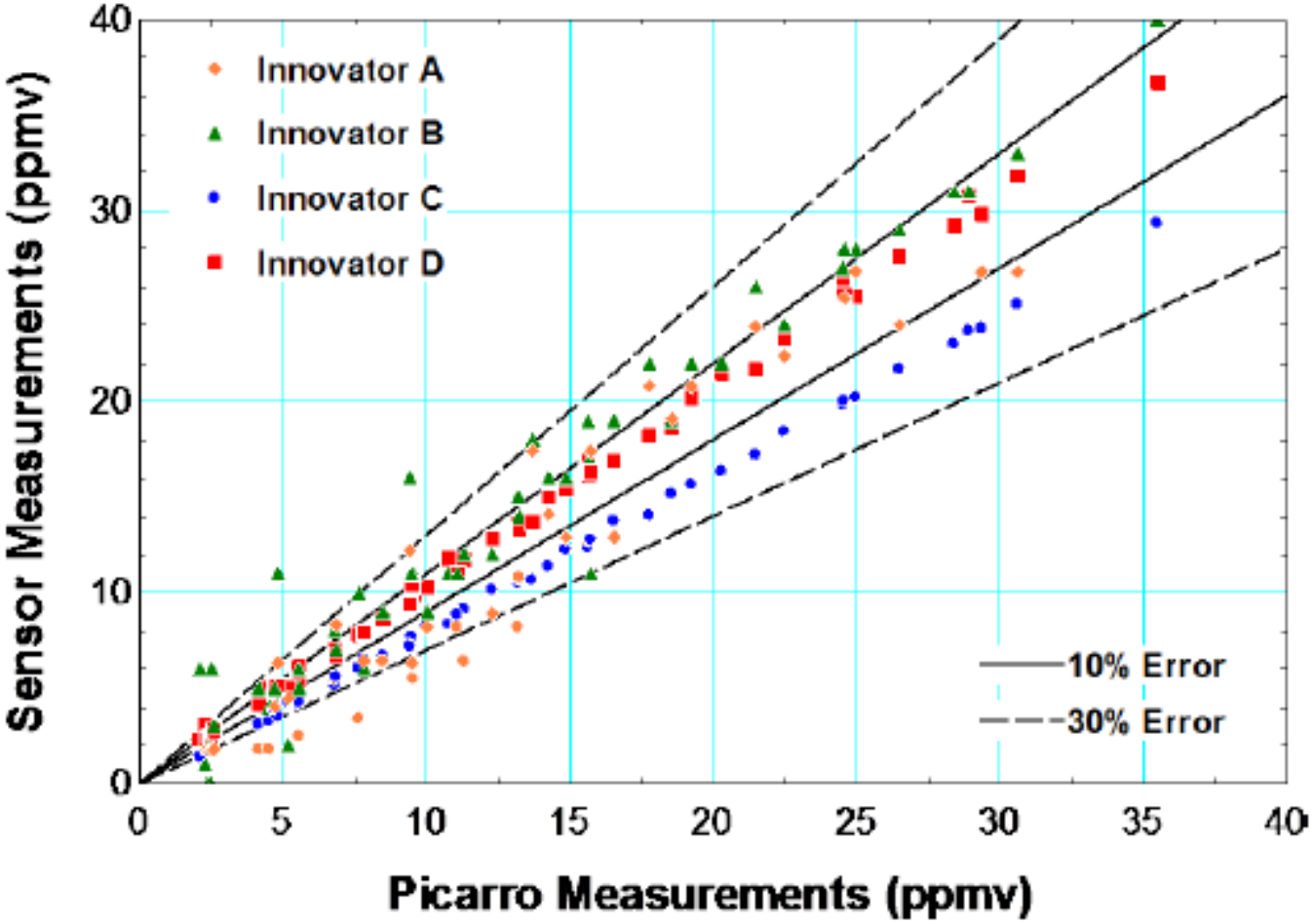


Figure 4.1. Sensor Measurements for Tests 1 and 2 of the Ambient Test.

Bringing innovation to life

U.S. methane policy

What is coming?

National Action to Reduce Methane is Underway

White House
Set goal to reduce methane by 40-45%

BLM
Will reduce methane waste on public lands

EPA
Will set rules for new/ modified sources

International

How do we take on the challenge?

Top global methane emitters

Table 2: Top 30 emitting countries in 2012

Excluding major oil and gas producers for which no data is available

	100-year GWP			20-year GWP	
	MT CO2e	% global o&g CH4	% country total GHG	MT CO2e	% country total GHG
Russia	387	23%	21%	1301	39%
US	192	11%	3.4%	647	8.7%
Uzbekistan	97	5.8%	42%	326	65%
Canada	54	3.2%	7.1%	180	17%
Mexico	43	2.6%	5.4%	146	11%
Azerbaijan	43	2.6%	53%	145	72%
EU	43	2.5%	1.0%	143	2.6%
Iran	43	2.5%	7.2%	143	18%
Venezuela	38	2.3%	16%	128	32%
Turkmenistan	37	2.2%	33%	126	47%
Algeria	30	1.8%	19%	99	38%
UAE	29	1.7%	10%	98	25%
Ukraine	29	1.7%	7.4%	96	17%
Nigeria	27	1.6%	8.1%	91	14%
India	25	1.5%	1.1%	85	2.3%

SOURCE: “Untapped Potential: Reducing Global Methane Emissions from Oil and Natural Gas Systems” (table excerpted in part)

Questions