Oil & Gas Methane Emissions: Lessons Learned

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EDF
ENVIRONMENTAL DEFENSE FUND®
Finding the ways that work

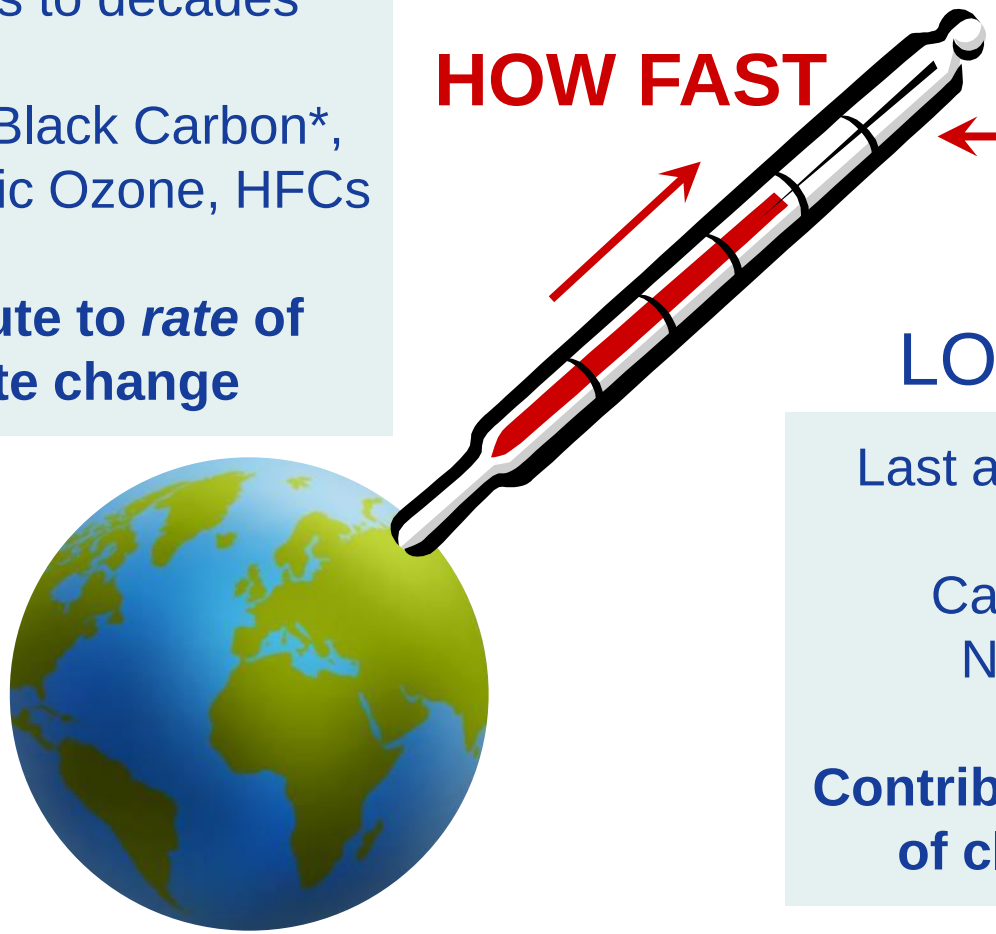
Distinct pollutant impacts on warming

SHORT-LIVED

Last days to decades

Methane, Black Carbon*, Tropospheric Ozone, HFCs

Contribute to *rate* of climate change



LONG-LIVED

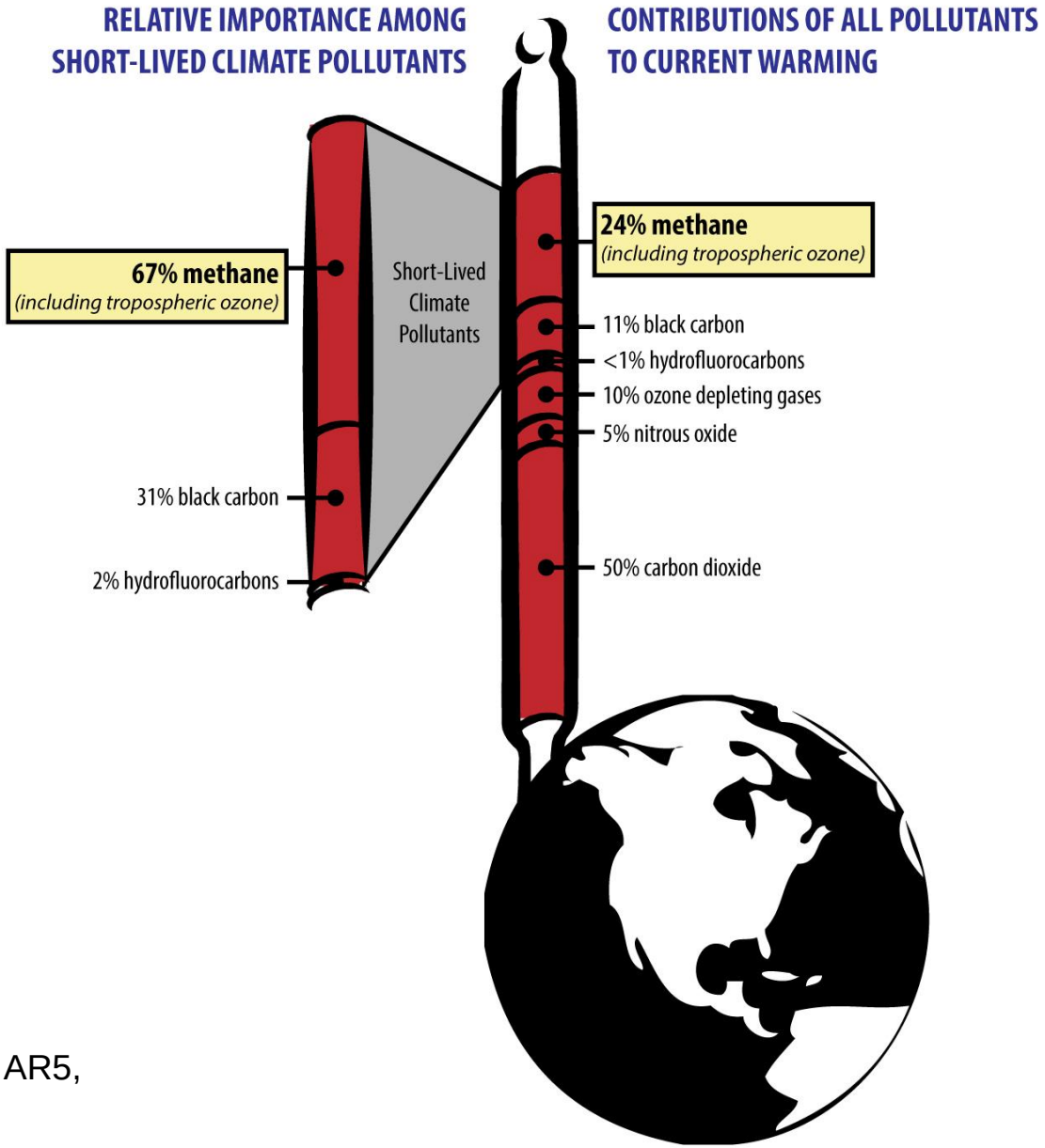
Last a century or more

Carbon Dioxide, Nitrous Oxide

Contribute to *magnitude* of climate change

**Black carbon not a gas, but a sunlight-absorbing aerosol*

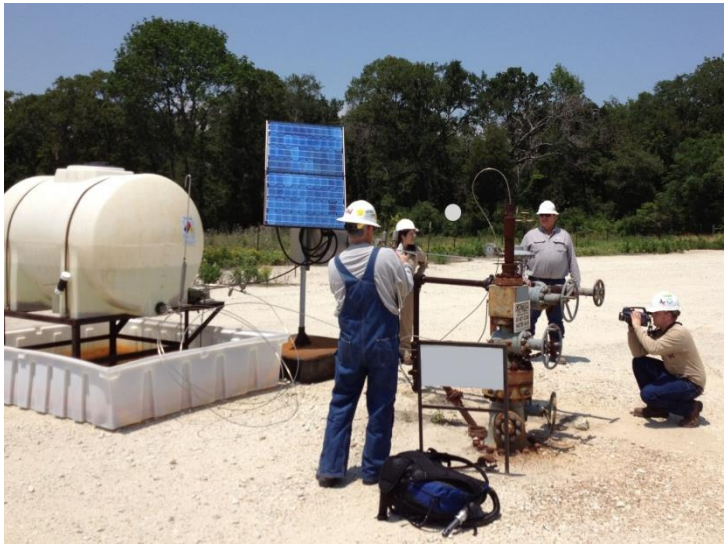
CH_4 causes ~25% of today's radiative forcing



Adapted from IPCC AR5, Table 8.SM.6

Catalyzing Science

EDF Coordinating 16 studies with >140 researchers from 35 institutions



Read more:
edf.org/climate/methane-studies

5 principles:

- Led by *academic scientists*
- Employ *multiple methodologies* whenever possible
- Seek review by *independent* scientific experts
- Make all data *public* to ensure *transparency*
- Publish results in a *peer reviewed science journal*

Different Methodologies

Most "Top Down" studies reveal higher emissions than "Bottom Up" methods.

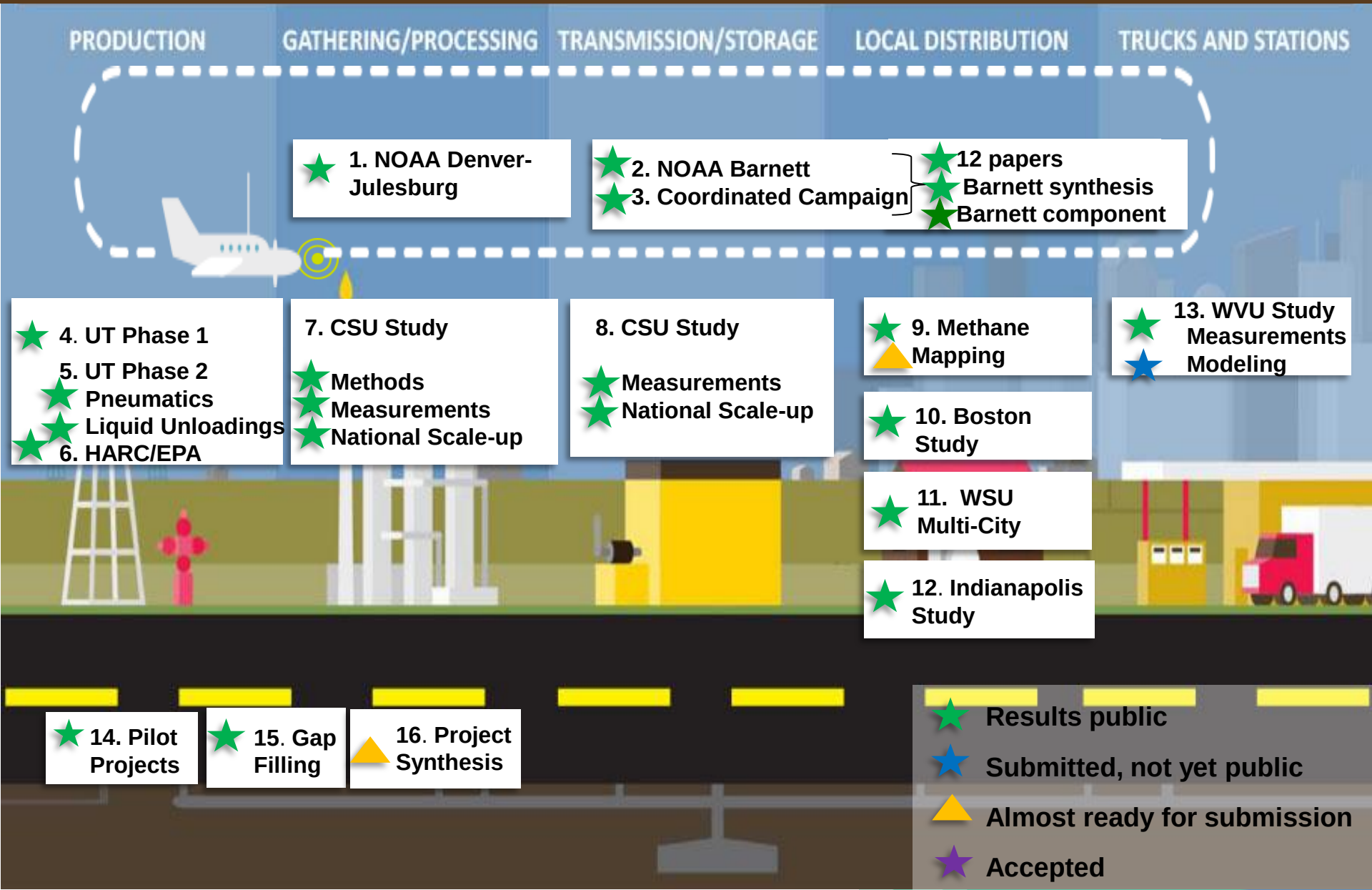
Top Down

- Large scale-regional or national estimates
- Mass balance
- Atmospheric transport models
- Enhancement ratios (e.g., CH4/CO2)
- Attribution to oil & gas required

Bottom Up

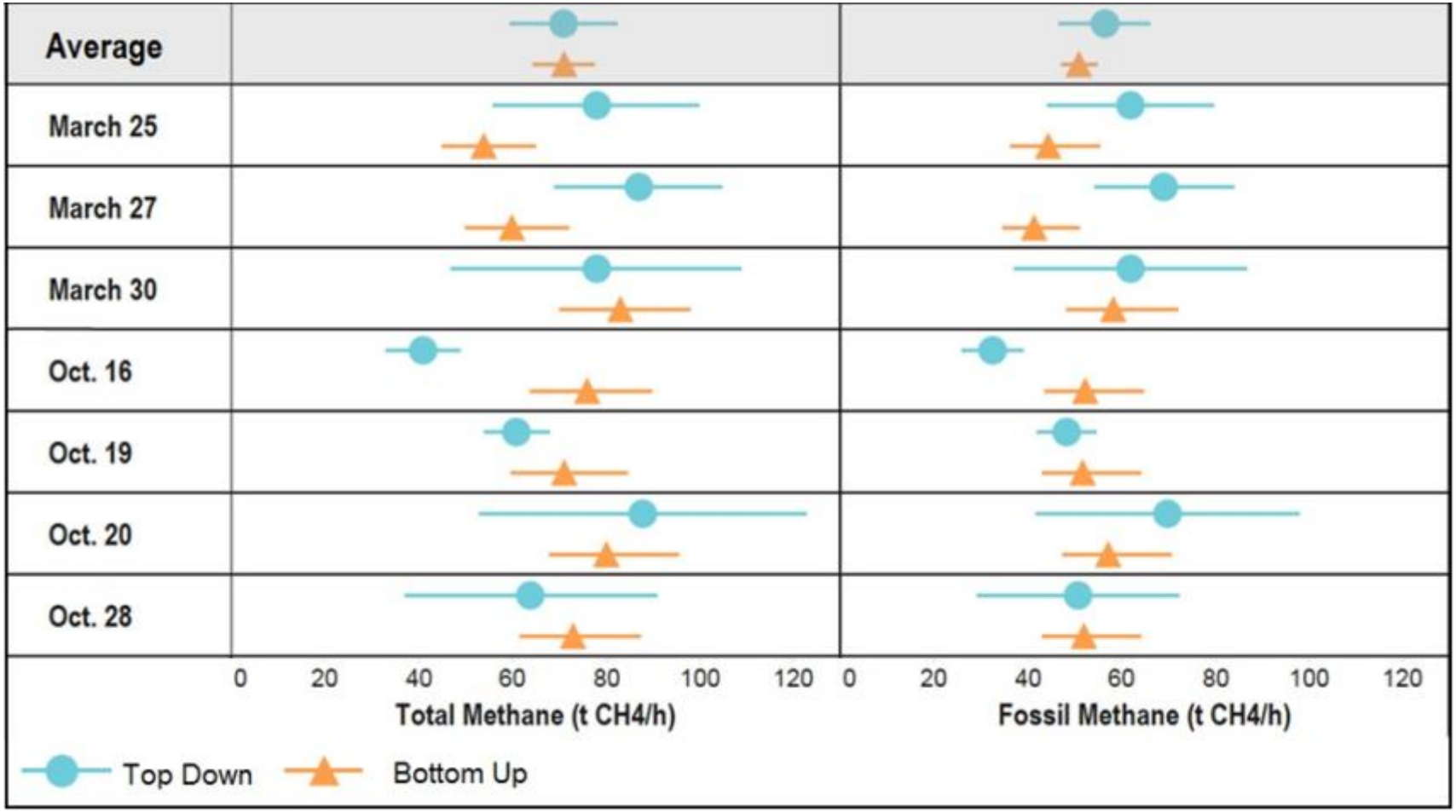
- Component- or activity-based
- Facility-level (0.05 to 5 km downwind)
- Combine emissions and activity factors

EDF STUDIES BY SUPPLY CHAIN SEGMENT: March 2017



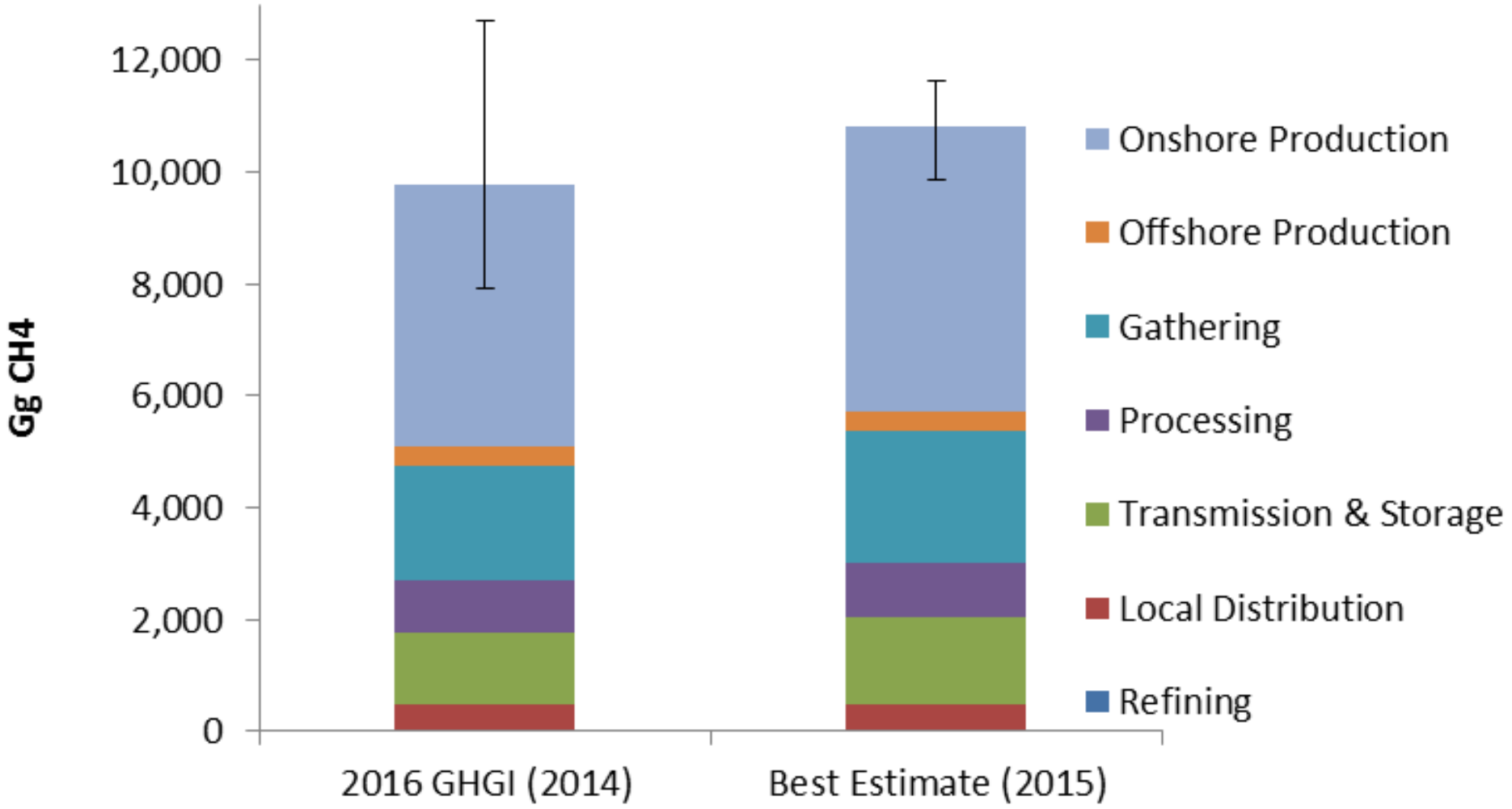
Barnett: Top-Down and Bottom-Up agree

Mean Relative Difference: 0.1% ± 21% (total) and 10% ± 32% (fossil)

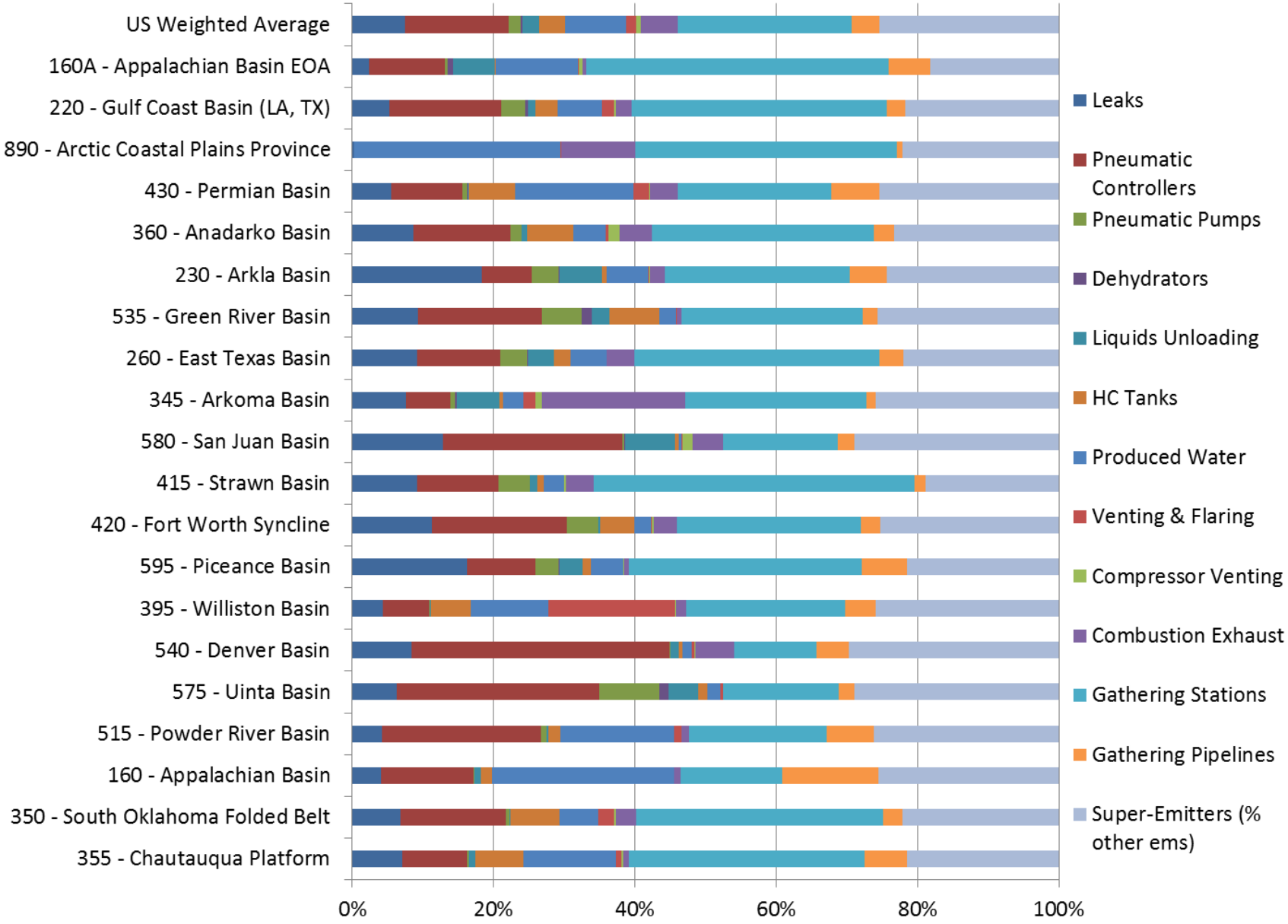


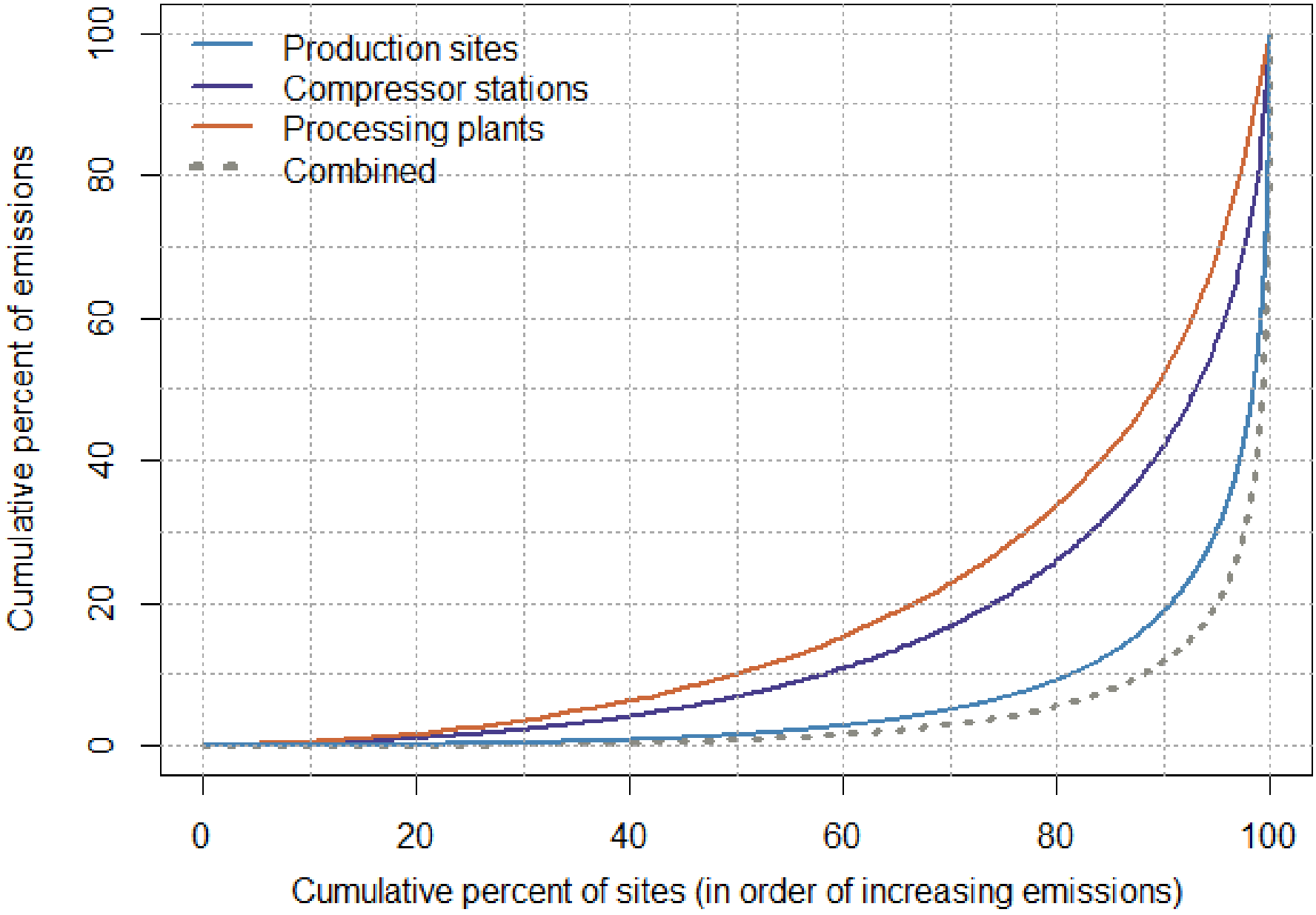
Zavala-Araiza et al. 2015 (PNAS)

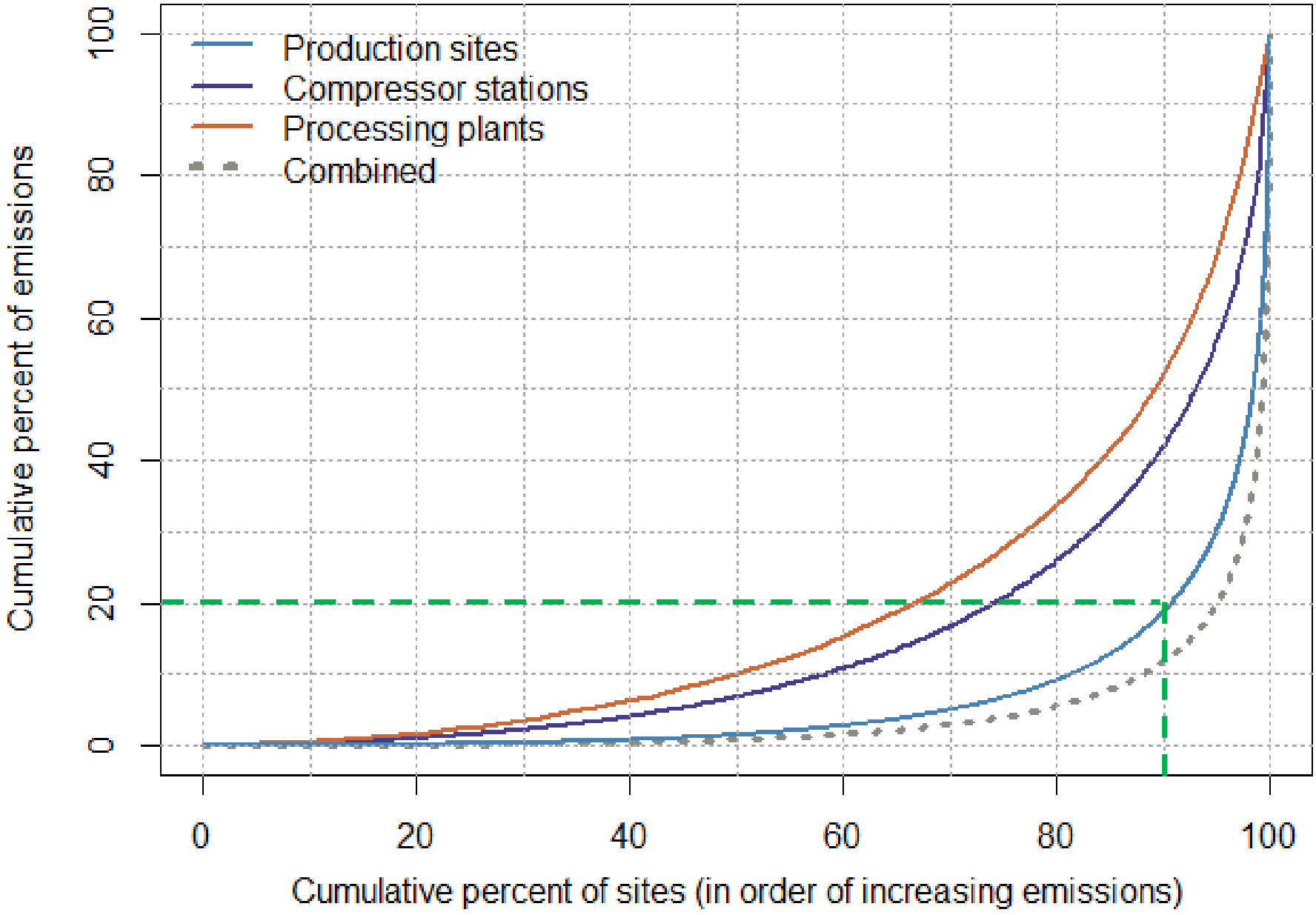
Preliminary
U.S. O&G CH_4 emissions
2016 EPA GHGI (9.9 – 11.7 vs 9.8 Tg)



Relative contribution of upstream emission sources varies substantially among basins




Production sites
Compressor stations
Processing plants
Combined
Cumulative percent of emissions
0
20
40
60
80
100
Cumulative percent of sites (in order of increasing emissions)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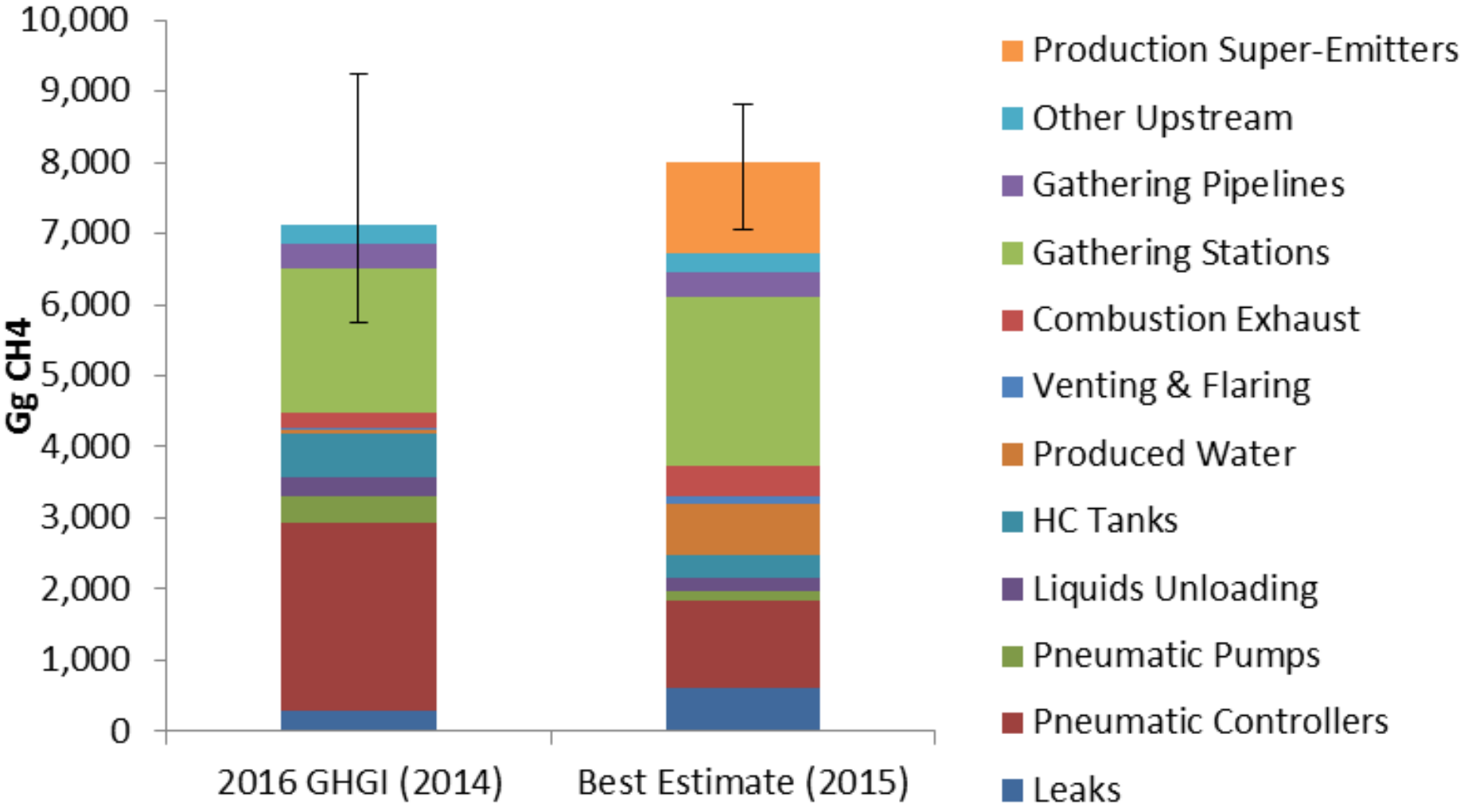
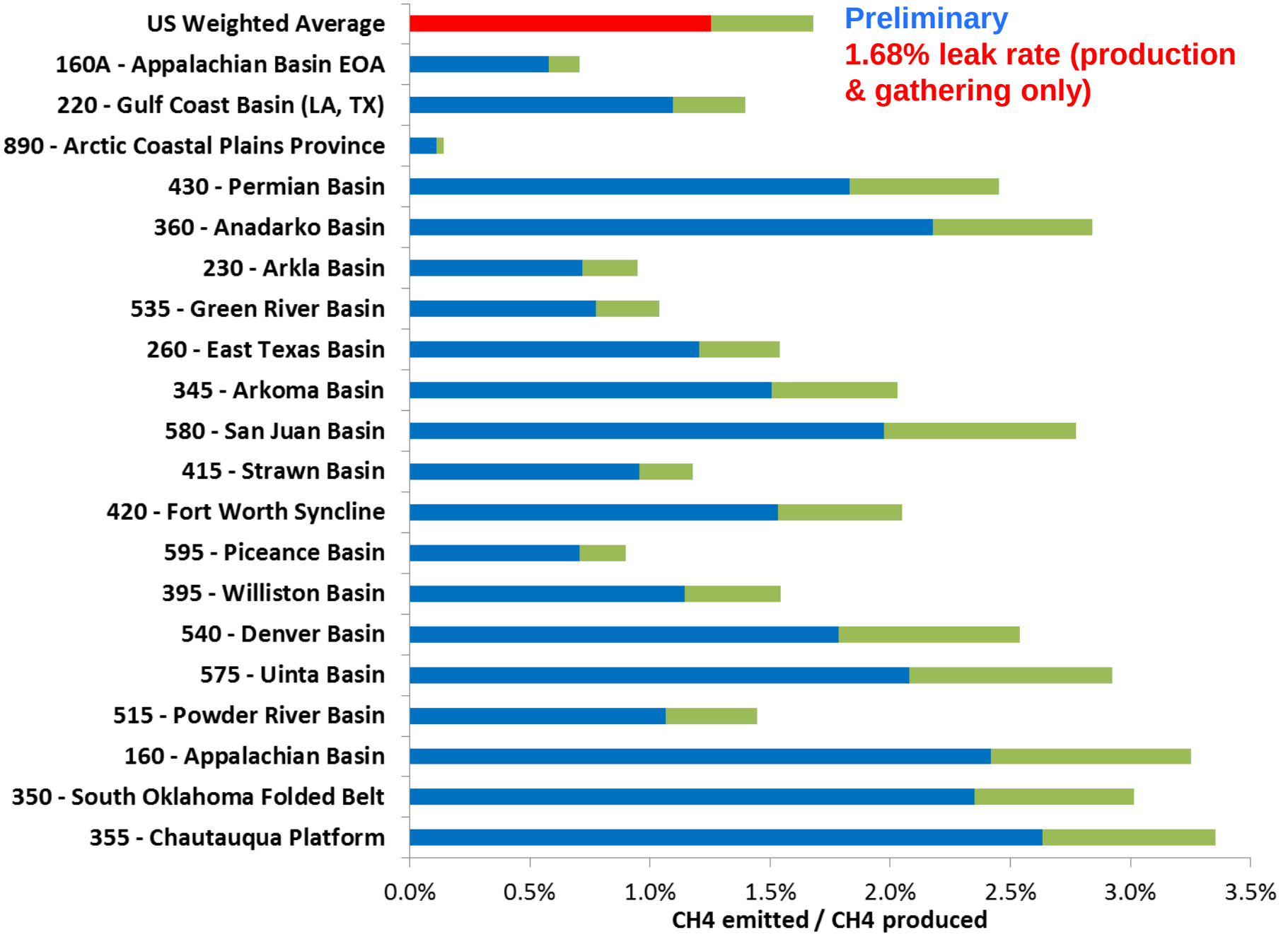
Cumulative percent of sites (in order of increasing emissions)

Preliminary
upstream emissions slightly higher
varies by source



Super-emitters = 55% of other production emissions

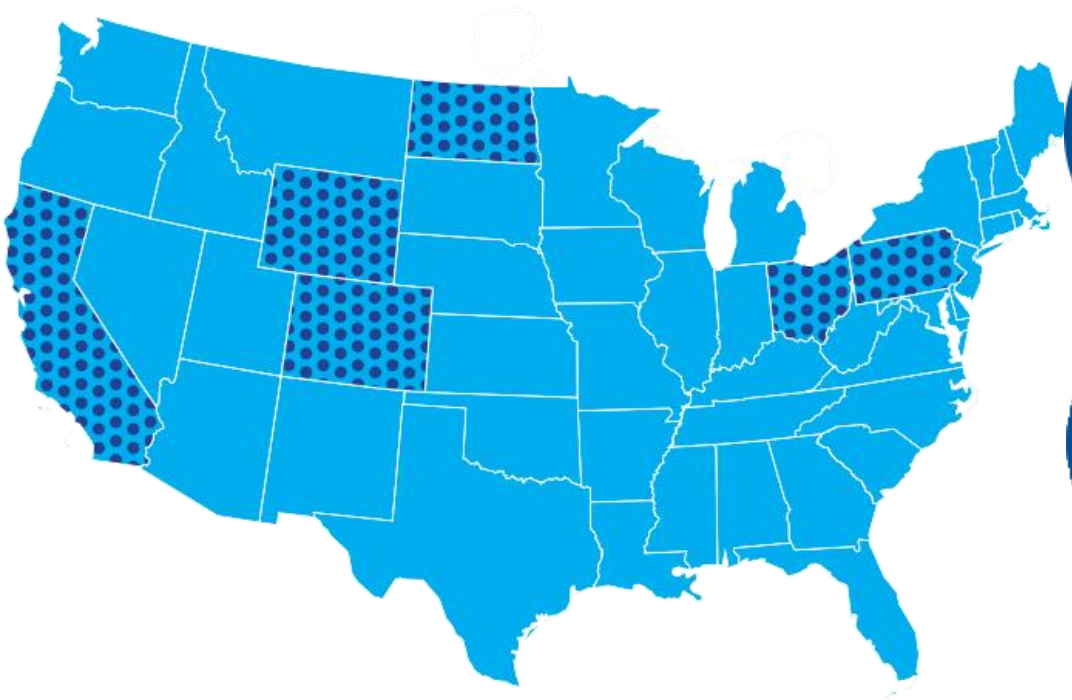


Ubiquitous Fat tail distributions

- How important?

- What it tells us about of methane emissions.

U.S. Methane Regulations Lessons Learned



Environmental Protection Agency oil & gas methane regulations in place.

EPA Action **+** States taking additional regulatory actions to address oil and gas methane emissions.

Higher Emissions

As a whole, oil & gas methane emissions are higher than conventional estimates suggest.

Super Emitters

Recurring, unpredictable problem not accounted for in inventories.

Regulations Work

- Industry/Govt/NGO can create collaborative, effective regs.
- Operators report success in CO.
- LDAR important tool for now.
- Tanks larger source.
- Equipment counts are low.

Global Methane Action

2014: **Colorado :** first US State to develop O&G methane regulations.

2015: **IEA Frames the Opportunity:** Scales potential reductions from O&G methane

Alberta: Alberta to cut 45% of oil & gas methane emissions by 2025

2016: **Investor Support:** Investors of $3 trillion back strong global methane regulations

North America. Mexico, Canada, U,S. pledge O&G methane cut of 45%

Major Oil and Gas companies (OGCI) announce plans

Global Momentum. Ministers from 19 countries identify O&G methane reductions as “next big climate opportunity”

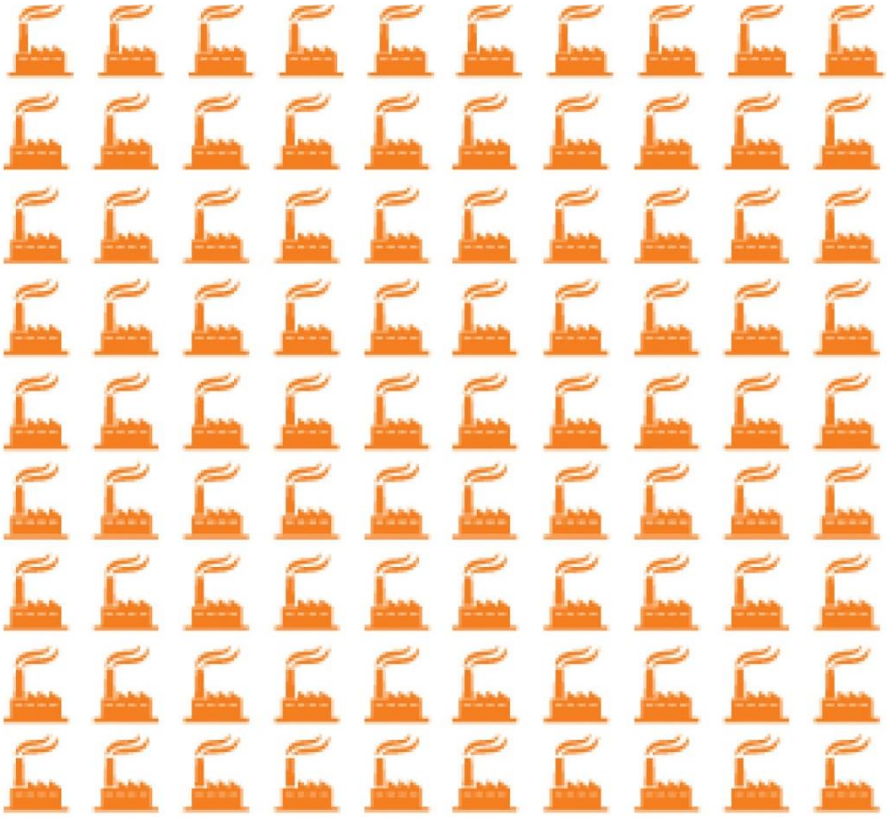
2017: **US State Leadership:** Ohio and California announces policies. O&G production covered by US state regulations 9th largest producer

North America and Norway Leading

- Norway
  - CO2 Tax Act, Petroleum Act (Flaring), Pollution Control Act
  - New venting can be almost eliminated
  - More sources identified than previously thought
  - Uncertainty about fugitive emissions
- Canada (Draft Federal regs expected in March)
  - Equipment count surveys found significantly more equipment than in inventory
  - Measurement data expected in Spring, CHOPs an issue
- Mexico
  - New methane regs expected to be announced this year.

Methane Reductions Can Have an Immediate Impact

LOWERING GLOBAL O&G METHANE EMISSIONS **45%**



Would achieve as much climate benefit in the next 20 years as closing

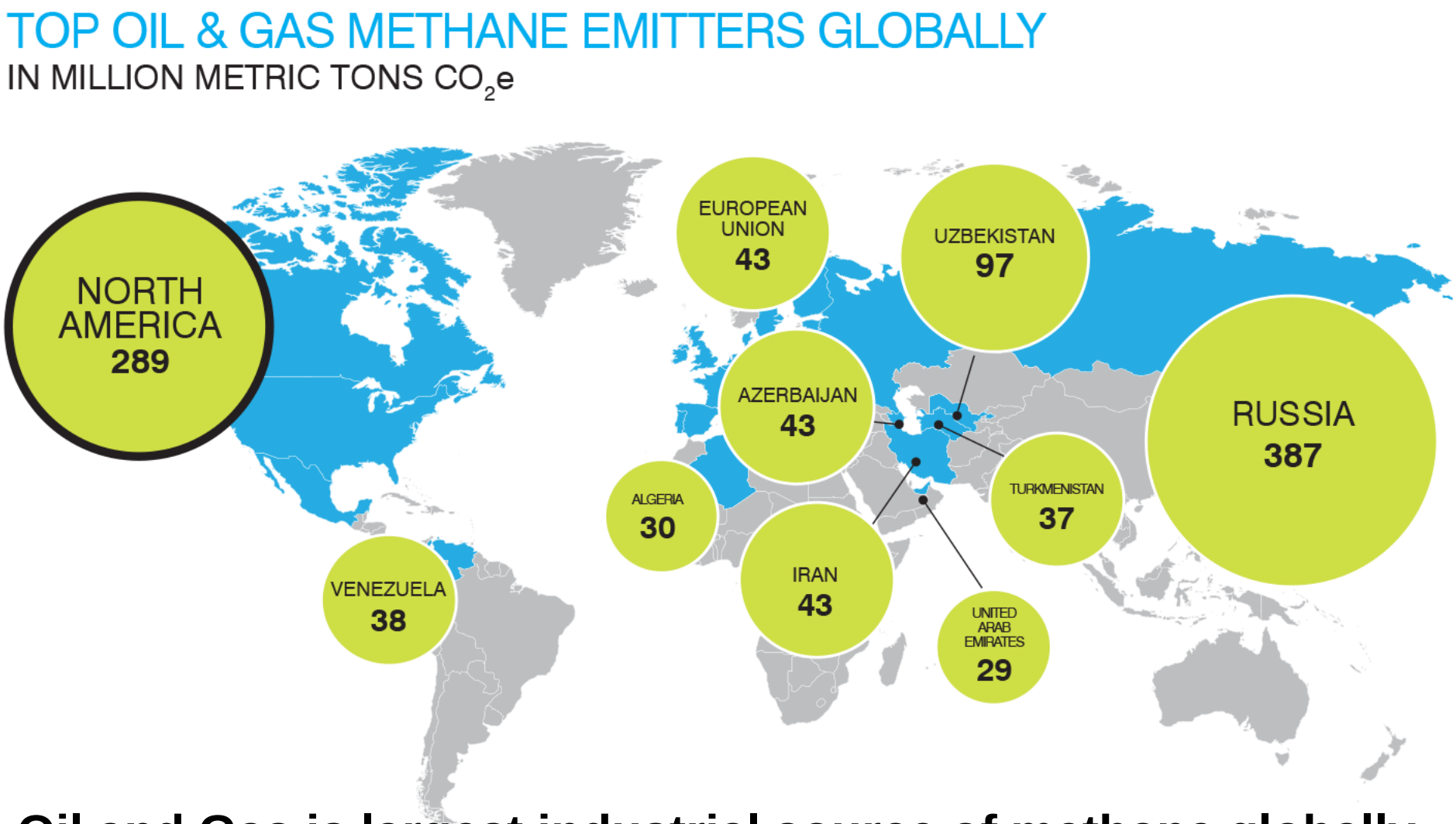
1000

COAL PLANTS

Each icon represents 10 coal plants

*Estimate based on EPA 2013 Greenhouse Gas Inventory

Estimated – we need more empirical data!



Oil and Gas is largest industrial source of methane globally. Scale of emissions shows further action needed.

Final Thoughts

- Empirical O&G methane emissions data required.
- Experience shows regulations can be developed and successfully implemented.
- Regulations need to address super-emitters.
- Transparency and reporting are key.
- Innovation can make reducing methane easier.

THANK YOU

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