Reliability of Emission Reduction Trends in Canada

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EPA Stakeholder Workshop on GHG Data

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Canada's Oil & Gas Industry

- 3rd largest oil reserves in the world
- Offshore
- Conventional oil, gas
- Unconventional sources
  - Tight Gas (CBM, SHG)
  - Oil Sands (CHOPS, SAGD, CSS)
- Regulatory differences

Canada’s Oil & Gas Industry

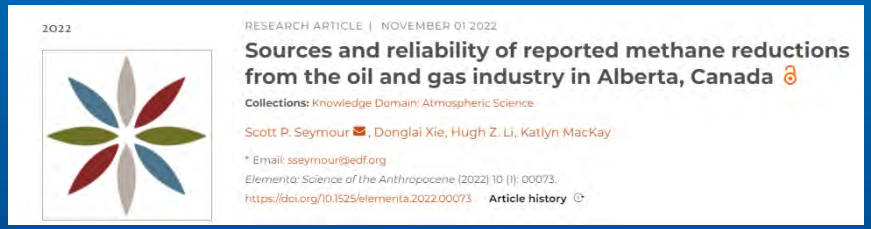
- Federal government committed to a **40-45% reduction in methane** from O&G by 2025
  - In 2020, new regulations were rolled out across Canada
  - Fully implemented beginning in 2023
- However, measurements suggest O&G methane is underestimated
  - ~1.4-2 times **(MacKay et al., 2021; Chan et al., 2020; Tyner & Johnson, 2021)**
- Inventory methods typically involved:
  - Generic emission factors, estimated emissions for unreported source types
  - Operator-reported emissions for flaring, venting, combusted gas

Inventory Analysis

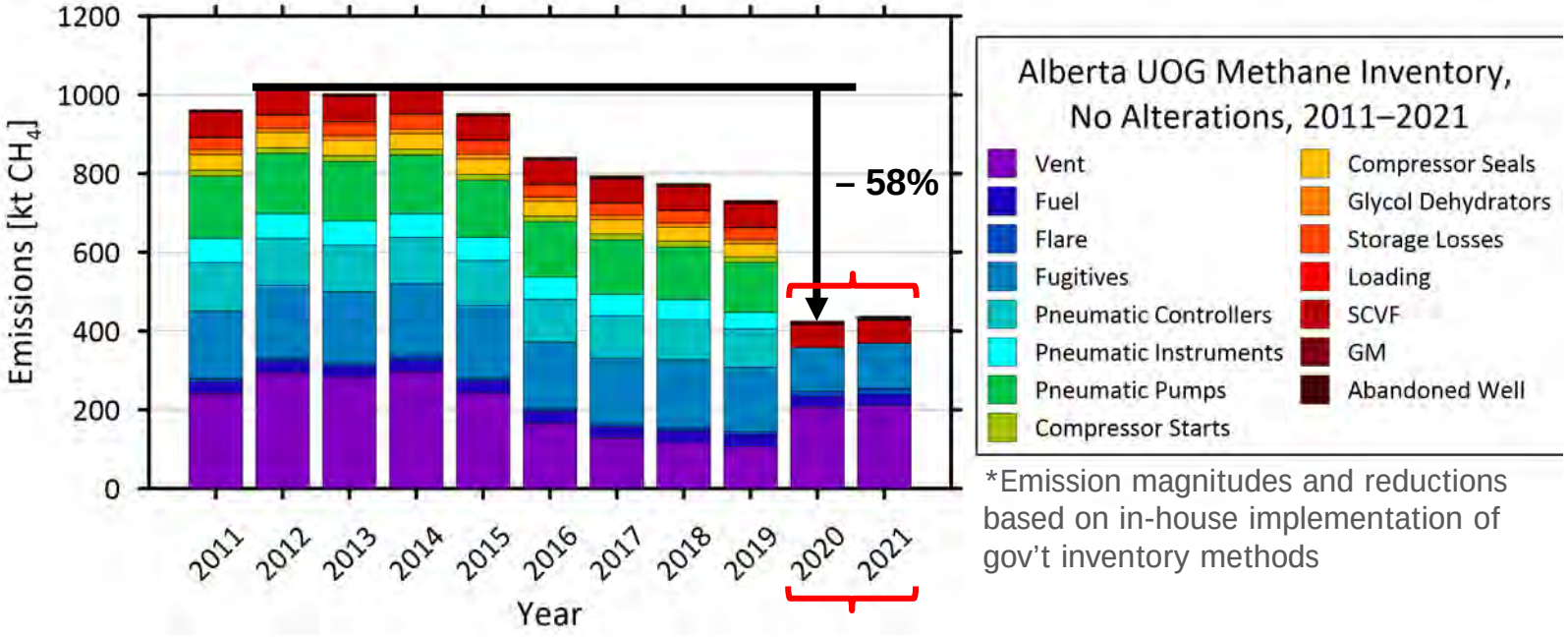
- Developed an upstream O&G methane inventory for Alberta
  - based on federal methods and data sources
  - leverages operator-reported activity data (Petrinex)
  - employs the same unreported emission estimates
- Excludes mined oil sands, upgrading

- **Petrinex:** Canadian O&G industry's activity reporting system
  - includes emissions, produced volumes, etc., with monthly, site-level resolution

Recently published:
DOI: 10.1525/elementa.2022.00073



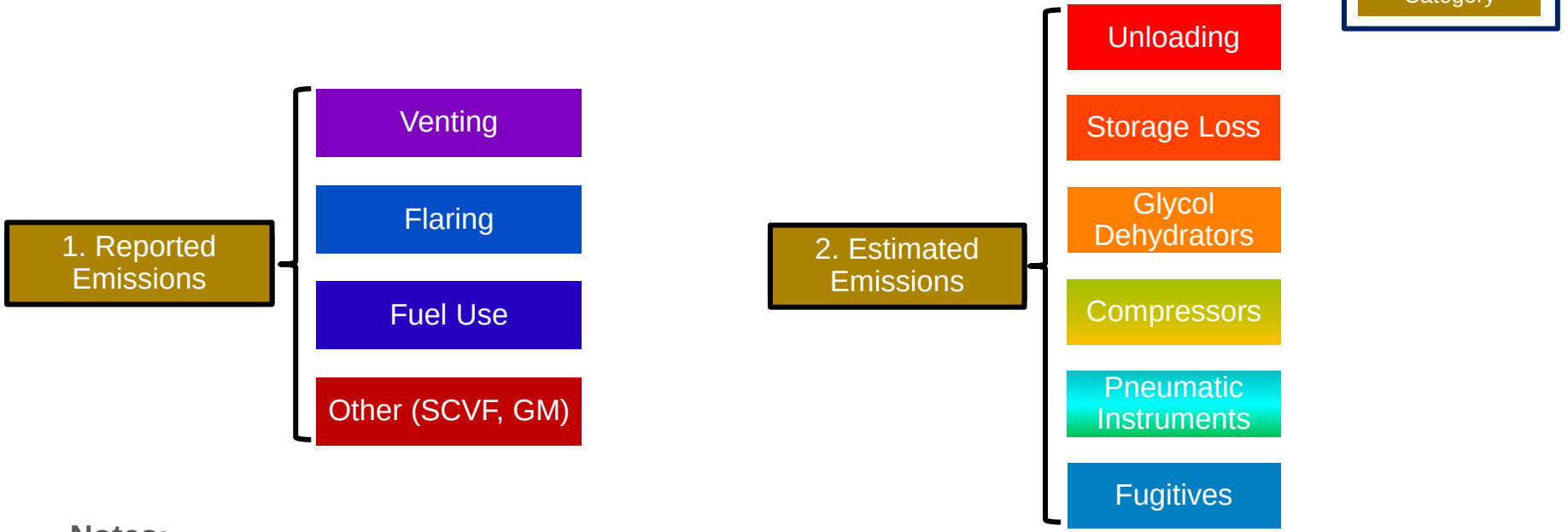
Alberta Inventory Model (2011 – 2021)



*Emission magnitudes and reductions based on in-house implementation of gov't inventory methods

- **Methane emissions apparently reduced significantly since 2012**
- In 2020, new regulations introduce venting limits, performance standards
- However, the inventory itself underwent a methodological shift

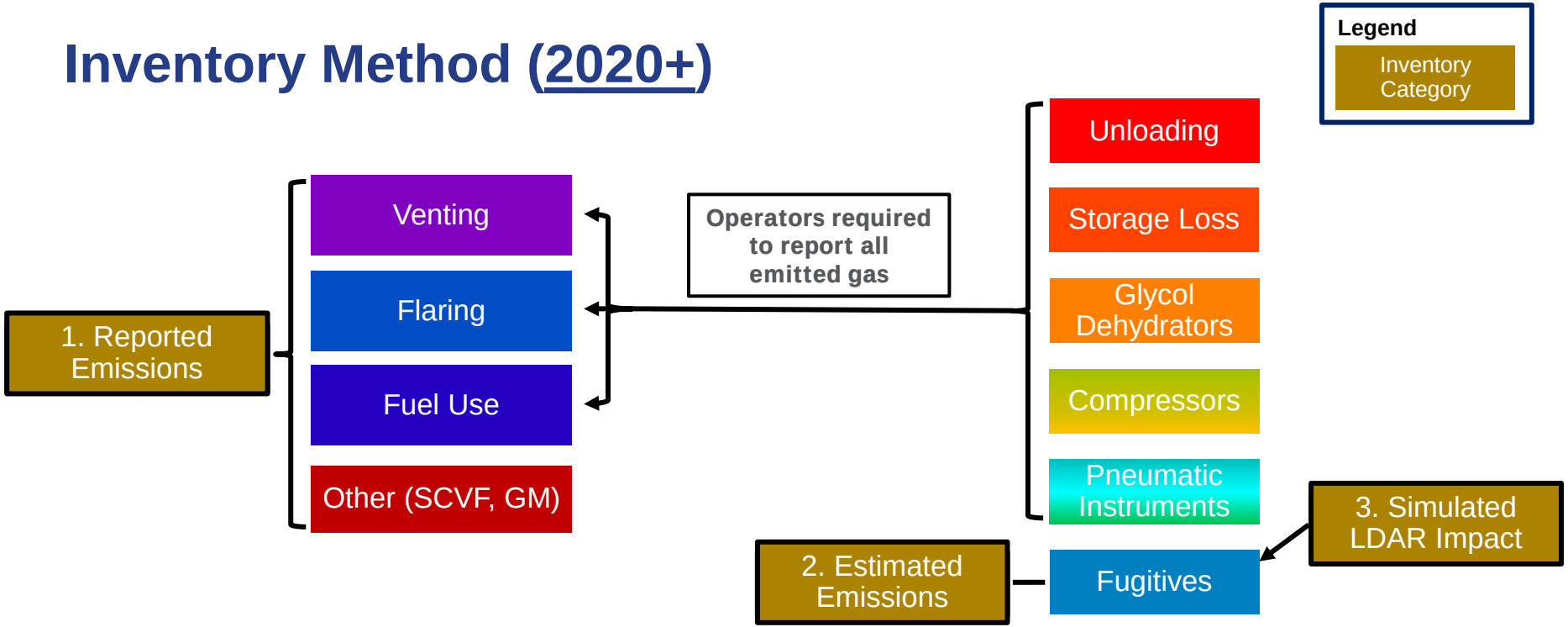
Inventory Method (2011-2019)



Notes:

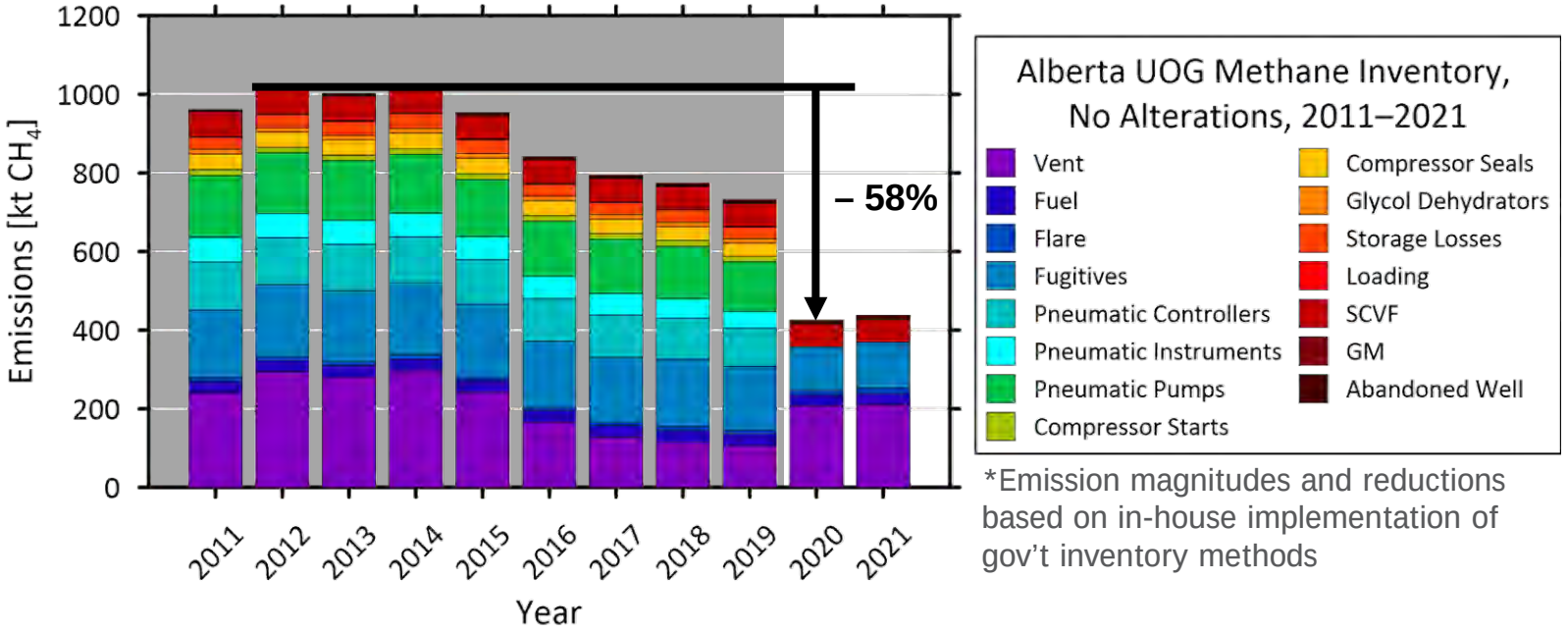
- Reported emissions from Petrinex (except for SCVF/GM, reported separately)
- Estimated emissions from Clearstone Engineering 2014 report (minor updates in 2018, 2019)
- Estimated emissions extrapolated to each year; scaled by broad production volumes or site counts

Inventory Method (2020+)



- Nearly all emission sources included in Petrinex vent, flare, fuel use volumes
- This shift was initiated by the provinces to theoretically improve reporting
- Modelled LDAR impact applied to modelled fugitive emissions

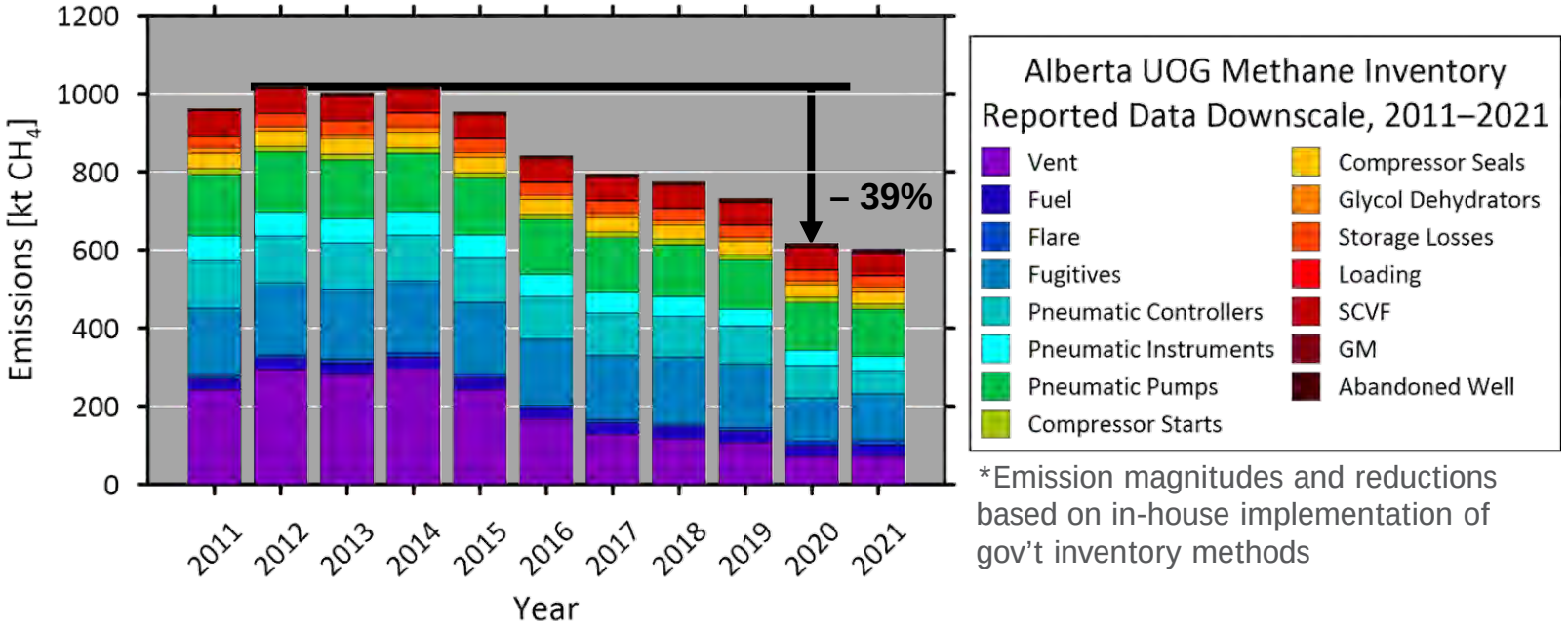
Alberta Inventory (2011 – 2021)



*Emission magnitudes and reductions based on in-house implementation of gov't inventory methods

- **Can 2012 and 2020 inventories be fairly compared?**
- **Can a reliable reduction be determined?**

Simulated Alberta Inventory (2011 – 2021)



*Emission magnitudes and reductions based on in-house implementation of gov't inventory methods

- Apply consistent model across all years
- 2020 emissions increase by nearly half

Inconsistency of inventory methods may overstate reductions

Case Study

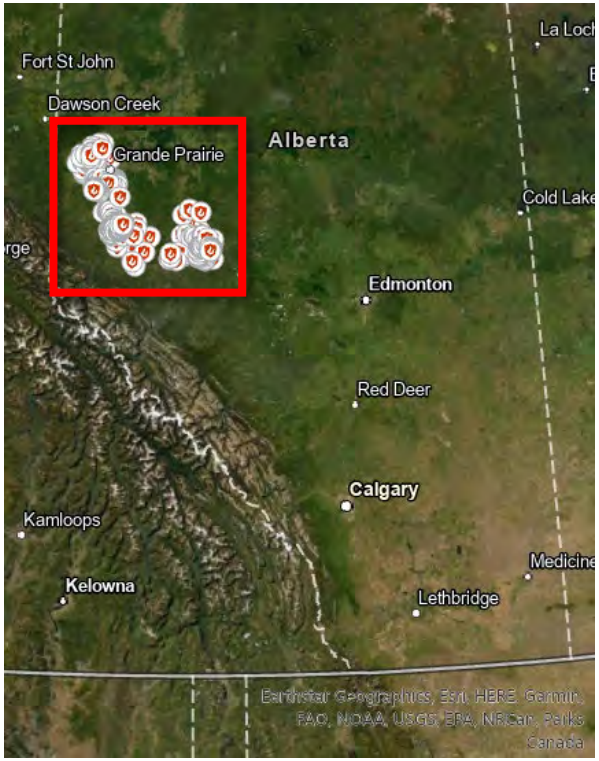
Helicopter-based survey of flares

- Optical Gas Imaging (OGI) camera used to identify unlit flares
- Observed sites compared with reported site emissions

2. Helicopter OGI Survey

- Aerial OGI survey of 284 unique sites
- +300 flare stacks observed
- Sites selected based on reported flare activity in Petrinex

Robinson R44 Helicopter

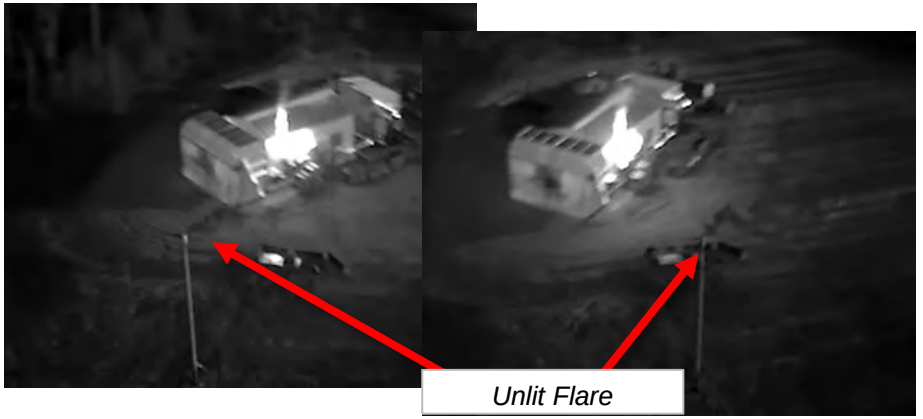


Surveyed Sites

2. Helicopter Survey

- **0.3% of flares were unlit** (1 of 288)
  - Flare was still unlit 8 days later
  - No venting was reported for the site
  - Different than recent findings in US **(Plant et al., 2022)**

- **16% of active flares were not reported Petrinex database**
  - Suggests a significant underreporting of flaring
  - Unclear if the same rate is true of reported venting emissions



Recommendations for Canada's Inventory

1. Measurement-based inventory
   - Replaces unreliable estimation methods
   - Improved methods will help focus on emission sources that matter
2. Include fugitive emissions by their equipment source
   - Currently, all abnormal/fugitive emissions included under generic category
3. Improved emissions reporting and validation
   - Ensure completeness and accuracy of reports
4. Clearly define emission reduction targets
   - **"40-45% reduction since 2012"** is uncertain if 2012 levels are uncertain

Learnings from Canada

1. Inventory changes should be accompanied by method comparison
   - Canada’s inventory change could not be undone with available data
   - Important for assessing emission trends

2. Reported emissions require added context to interpret
   - For example, measurement hardware and methods

3. Reporting compliance verification and emission rate validation

Summary

1. Emission reductions are uncertain because of an inventory methodology shift
   - uncertainties also in LDAR models, estimated emissions, etc.

2. Measurements suggest that emissions are still underestimated
   - Uncertain if reductions in underestimated sources are well-described

3. The combined uncertainty makes progress towards emission reduction targets difficult to validate
   - Need for a measurement-based inventory

thank you

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