Current Practices and Future Projections

Workshop to Develop Recommendations for Environmental Monitoring Related to Unconventional Oil and Gas Extraction

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Overview of unconventional resources

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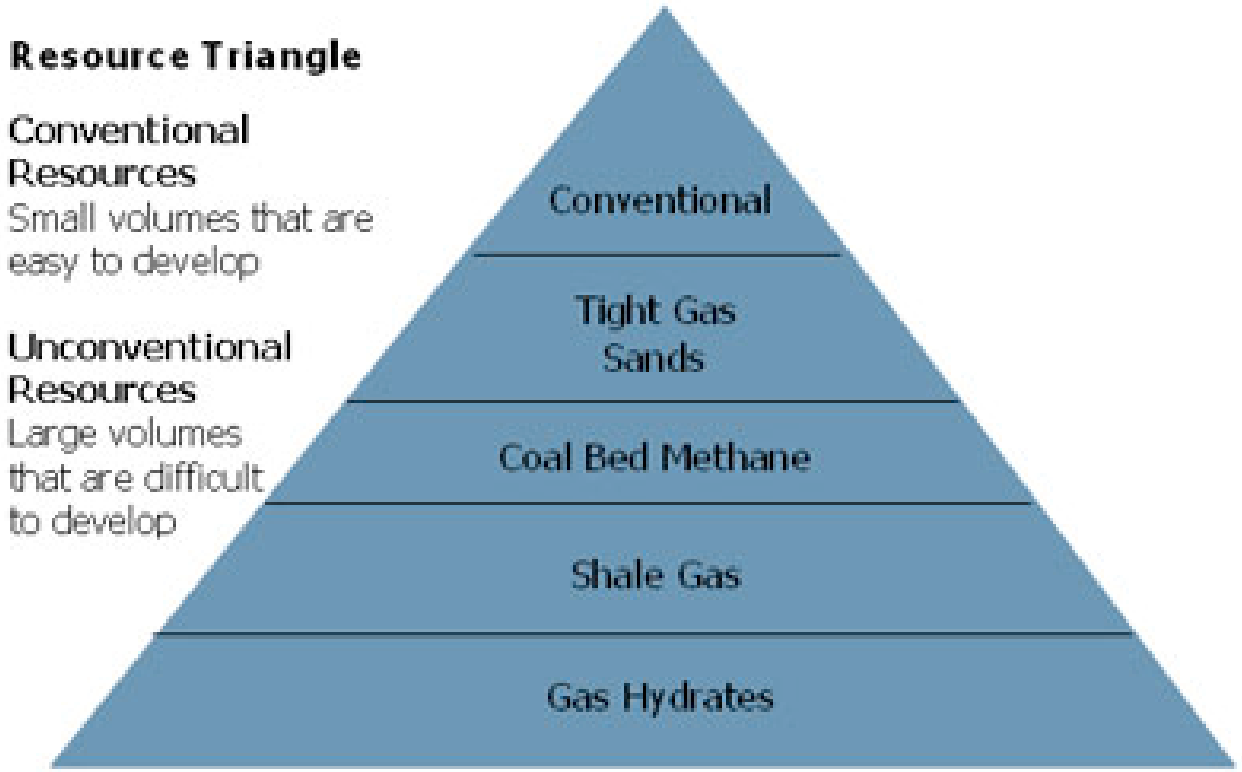
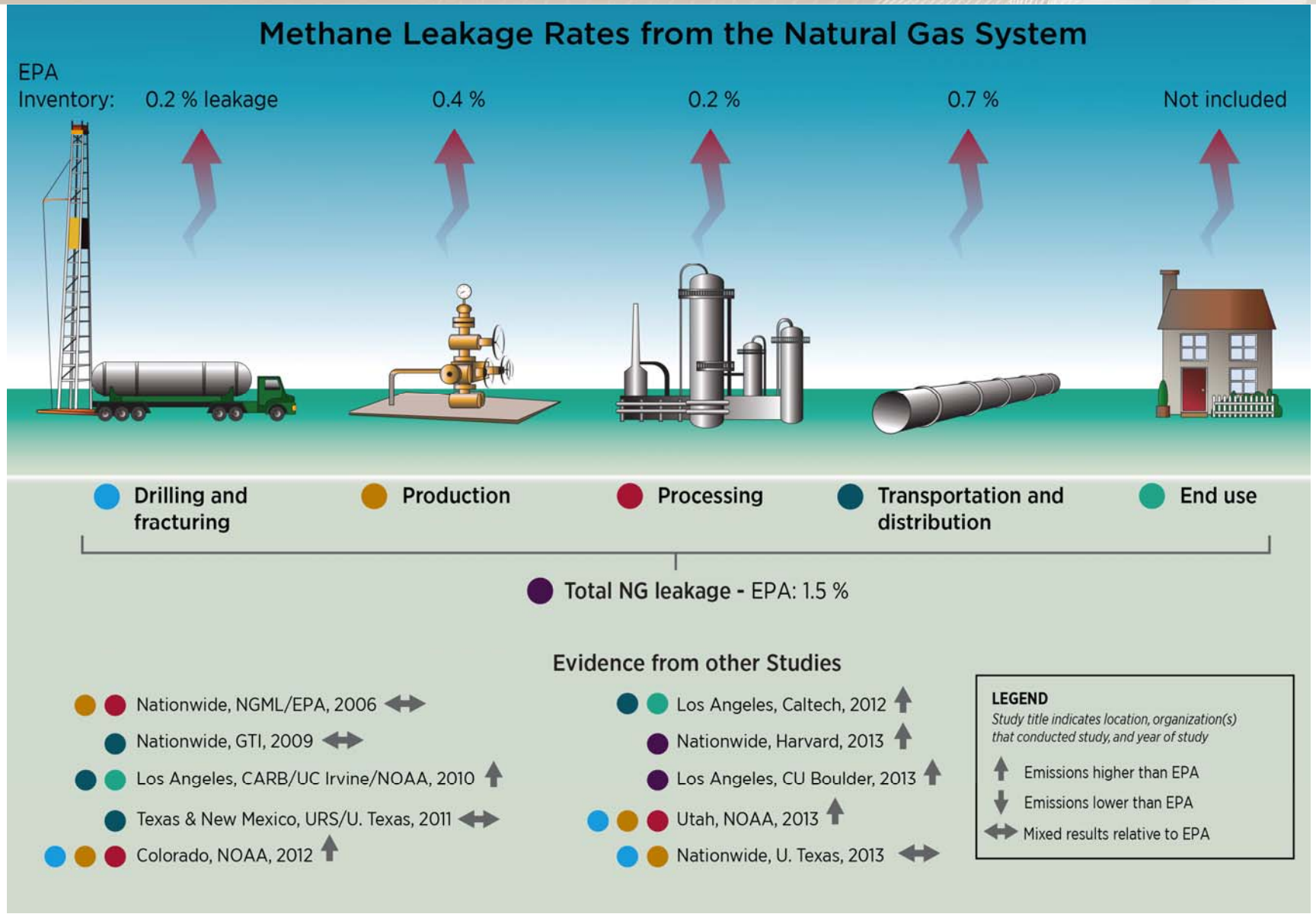


- Similar for unconventional oils
- Spectrum of wells, liquids/gas production varies by region
- Gas wells aren't always gas wells and oil wells aren't always oil wells
- E.g. Arizona: <50,000 cubic feet of gas per barrel of oil means an oil well



Brandt et al (2014)

Summary

Air quality	Water quality
Challenges Fugitive emissions of methane NOx, VOCs (ozone precursors), H_2S	**Challenges** Spills Adequate treatment versus disposal Fluid characterization Well-bore integrity Seismicity Leaks from impoundments
Current practices Metered wells Air tower measurements Flights Picarro/Mobile vans LIDAR Village green, EPA	**Current practices** Spill prevention, clean up Produced water management Water quality monitoring Zones of presumption – PA, distance to well and contamination

Key questions

- Air monitoring:
  - What measurement methods should be used?
  - What types of analytic methods to be employed?
  - What mitigation technologies are available/needed?
  - How can we ensure baseline monitoring and reporting is adequate?
  - What regulations are required to meet these goals?
  - How to attribute correctly?

- Water Monitoring:
  - What contamination pathways should be considered?
  - What type of mitigation is required for each pathway?
  - How can we ensure baseline monitoring and reporting is adequate?
  - What regulations are required to meet these goals?
  - How to attribute correctly?

Growth of shale gas production in the US