

### Investigating Methane Emissions from California's Natural Gas System

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Methane Emissions from California's Natural Gas System: Challenges and Solutions June 6, 2016



### **Outline**

- Historical context: Energy Commission's prior research on methane emissions from California's natural gas\* system
- Overview of PIER (Public Interest Energy Research)
   Natural Gas research on methane emissions
- Upcoming project and next steps



### **Historical Context**



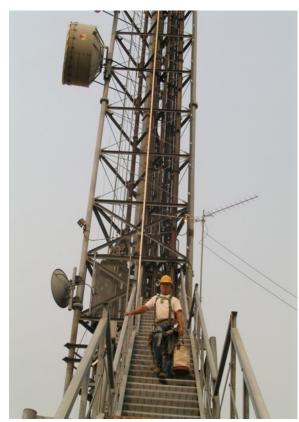


### **Ambient Methane Measurements**

- Institution: Lawrence Berkeley National Laboratory
- Instrumented two communication towers (Walnut Grove and Sutro) to measure methane concentration
- The Air Resource Board continued and expanded the measurements



Courtesy of Dr. Marc Fischer, LBNL





#### CALIFORNIA ENERGY COMMISSION

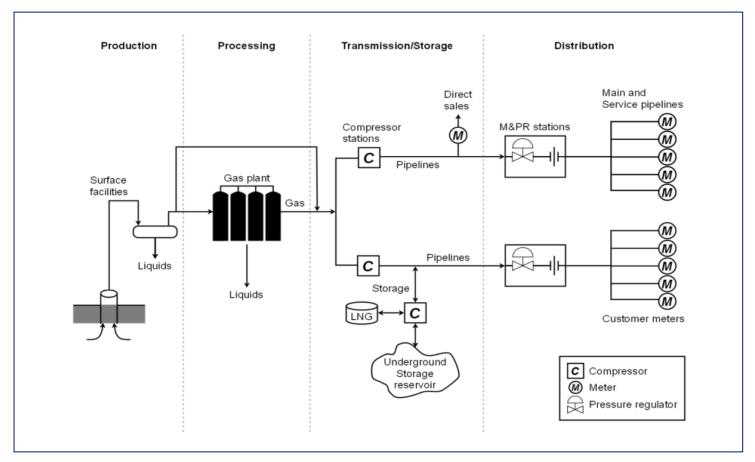


"California....becoming the **first** US state to gather such regional data"

Nature. **October 2007** 



### Classical Schematic Representation of the Natural Gas System





Revised Schematic Representation of the Natural Gas System **Fugitive Legacy Emissions Power Plants** Production Processing Transmission/Storage Distribution Direct Main and Downstream Uses Service pipelines sales M&PR stations Compressor (M) stations Homes Pipelines Gas plant Surface facilities Pipelines С **Buildings** Liquids Storage Liquids LNG Customer meters Underground **C** Compressor Storage Abandoned Industry and reservoir Meter Wells Transportation Pressure regulator **NATURAL GAS SYSTEM** 

Franco, Ziaja, Hou, Bining. Methane Emissions Associated with Natural Gas Consumption in California. Draft Staff Paper. 2015

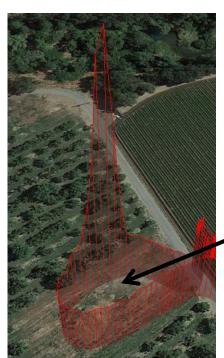


### Overview of PIER Natural Gas Projects





# Methane Emission Measurements in the Natural Gas System



Capped well



LBNL Mobile System



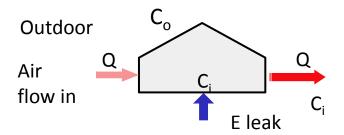
Courtesy of Dr. Marc Fischer, LBNL

Other sources tested: underground storage units, NG vehicle fueling stations, ~10 homes, Refineries (aircraft), NG fields (aircraft)

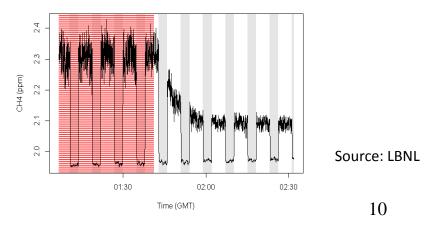


### **Emission from Homes (LBNL)**

- Preliminary test indicate notable emissions from homes
- Measurements in ~75 additional homes
- Data also indicates methane from incomplete combustion of home appliances



Measured indoor (white) and outdoor (grey) methane during calibrated indoor leak (red)





### Emission from Buildings (GTI, ICF)

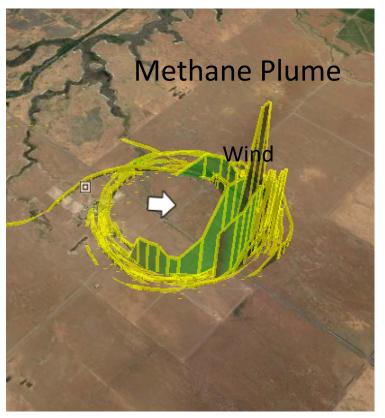
- Field measurements of buildings from multiple regions in California
- Gas Technology Institute plans to test approximately 40 restaurants and healthcare facilities
- ICF International plans to conduct tests in other building types (e.g., schools)
- Appliances will be also tested
- Expected completion: 2019



## Emission from Natural Gas Pipeline and Storage Facilities

- Validated by controlled release
  - Methane release rate: ~15 kg hr<sup>-1</sup>
- Use of an ethane sensor to distinguish leaks of natural gas from other sources



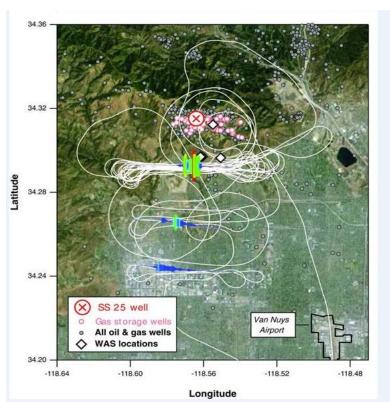


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### Natural Gas Storage Facilities







### Publication in Science

GAS INFRASTRUCTURE

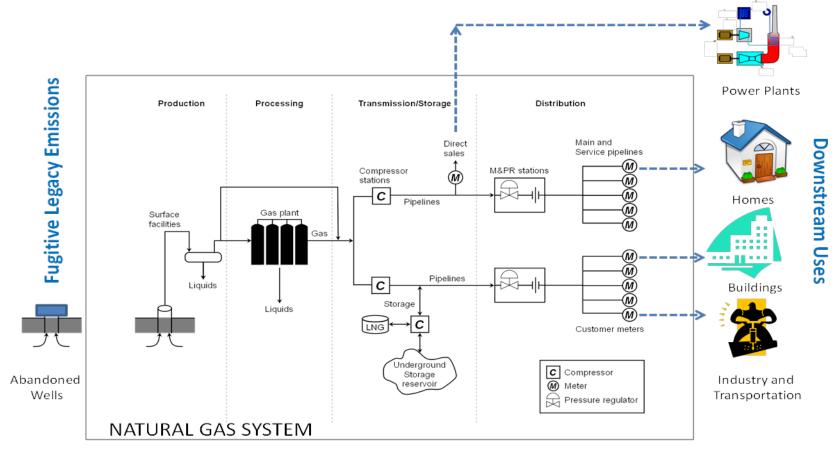
# Methane emissions from the 2015 Aliso Canyon blowout in Los Angeles, CA

S. Conley, 1,2\* G. Franco, I. Faloona, D. R. Blake, J. Peischl, 5,6 T. B. Ryerson +

Single-point failures of natural gas infrastructure can hamper methane emission control strategies designed to mitigate climate change. The 23 October 2015 blowout of a well connected to the Aliso Canyon underground storage facility in California resulted in a massive release of natural gas. Analysis of methane and ethane data from dozens of plume transects, collected during 13 research-aircraft flights between 7 November 2015 and 13 February 2016, shows atmospheric leak rates of up to 60 metric tons of methane and 4.5 metric tons of ethane per hour. At its peak, this blowout effectively doubled the methane emission rate of the entire Los Angeles basin and, in total, released 97,100 metric tons of methane to the atmosphere.



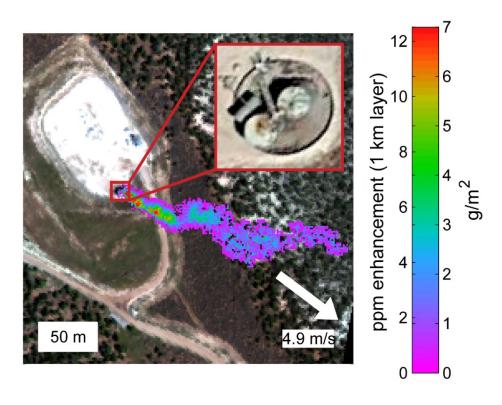
### **Upcoming Project and Next Steps**





#### ARB-NASA-CEC Joint Effort

- NASA/JPL Methane Survey Project
- Collaborative effort between the ARB and the Energy Commission
- The Energy Commission project will focus on the natural gas system
- Coordinating with Division of Oil, Gas and Geothermal Resources (DOGGR)
- Project will identify large emitters



Source: Aubrey et al., NASA, 2015

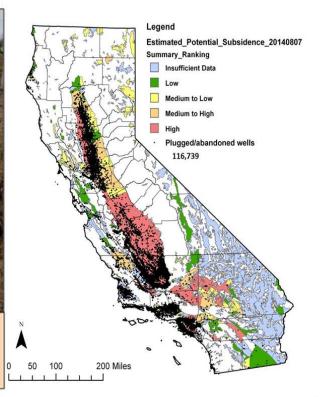


### Natural Gas Research Plan

- After-the-meter emissions in Industrial and power sectors
- Groundwater related subsidence impacts on the natural gas system:
  - underground storage
     Facilities
  - pipelines
  - abandoned natural gas wells



2 year old well (drilled 2010). Land surface shows 2 feet of subsidence (well location shown on map). Photo courtesy Sarge Green, California Water Institute.





### Summary

- The Energy Commission has been working on this topic for a long time
- Progress made in identification and characterization of the emission sources, measurement techniques. However, much work is still needed
- Working closely with ARB, DOGGR and other entities, the Energy Commission continue to support research in this topic area through the PIER Natural Gas program



### Thank you!



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