


A Natural Gas Primer



California Women in Energy
Women EmPOWERED Energy Forum
December 12, 2016

Overview

- Natural Gas Basics
- California Natural Gas Infrastructure
- California Supply & Demand
- Natural Gas Regulation Overview
- Challenging Issues for Regulators

Gas Production

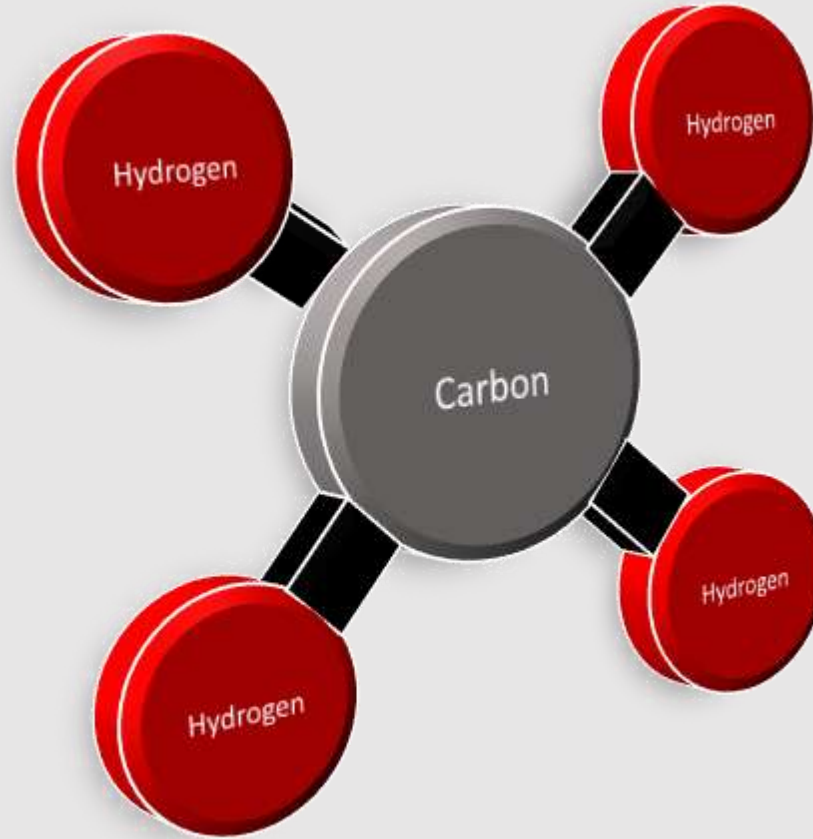
- Natural Gas Production
 - Conventional production
 - Non-conventional production
 - Shale
 - Tight sands
 - Coal-seam
- Biomethane Production
 - Food stock (e.g., corn, wheat, sugar cane)
 - Grasses
 - Waste (e.g., waste oil, manure, municipal solid waste)
 - Algae

What is Natural Gas?

It's All About the Methane

Natural Gas

60-95% Methane
Carbon Dioxide
Hydrogen Sulfide
Oxygen
Nitrogen
Water
Ethane
Propane
Butane
Other Alkanes &
Constituents



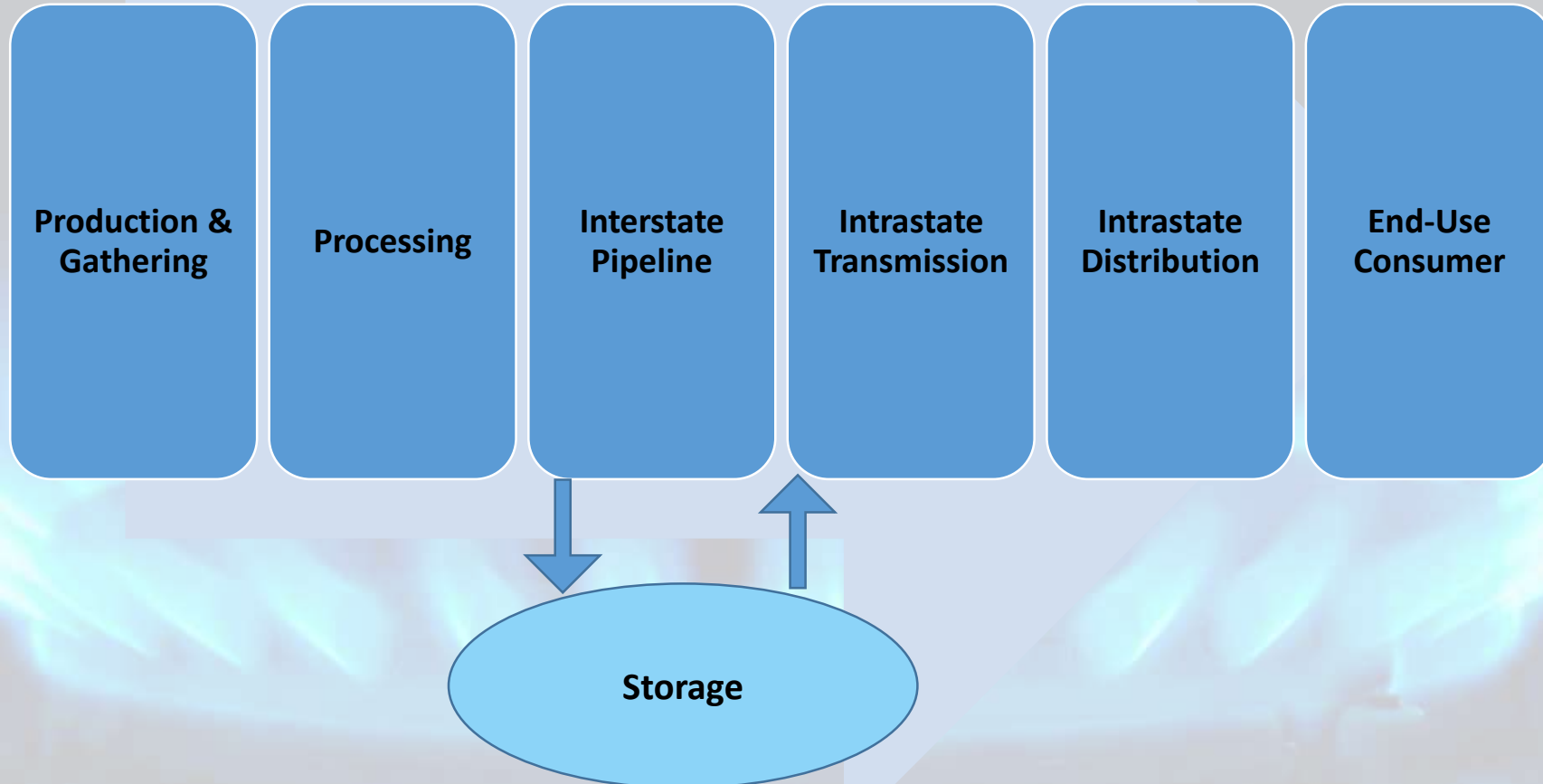
Other Biogas Constituents

Arsenic
Dichlorobenzenes
Ethylbenzene
n-Nitroso-di-n-propylamine
Vinyl Chloride
Antimony
Copper
Lead
Methacrolein Toluene
Alkyl Thiols (mercaptans)
Siloxanes
Ammonia
Mercury
Biologicals

Useful Conversions

British thermal unit (Btu)	Heat to raise 1 lb water 1° F
Therm (th)	100,000 Btu
Decatherm (Dth)	10 therms or 1,000,000 Btu
Million British thermal units (MMBtu)	Dth
Cubic foot (cf)	1,032 Btu (average based on heating value)
Thousand cubic feet (Mcf)	1.032 MMBtu or Dth
Carbon emissions coefficient (lbs)	117 lbs/MMBtu
Carbon emissions coefficient (kg)	53.07 kg/MMBtu

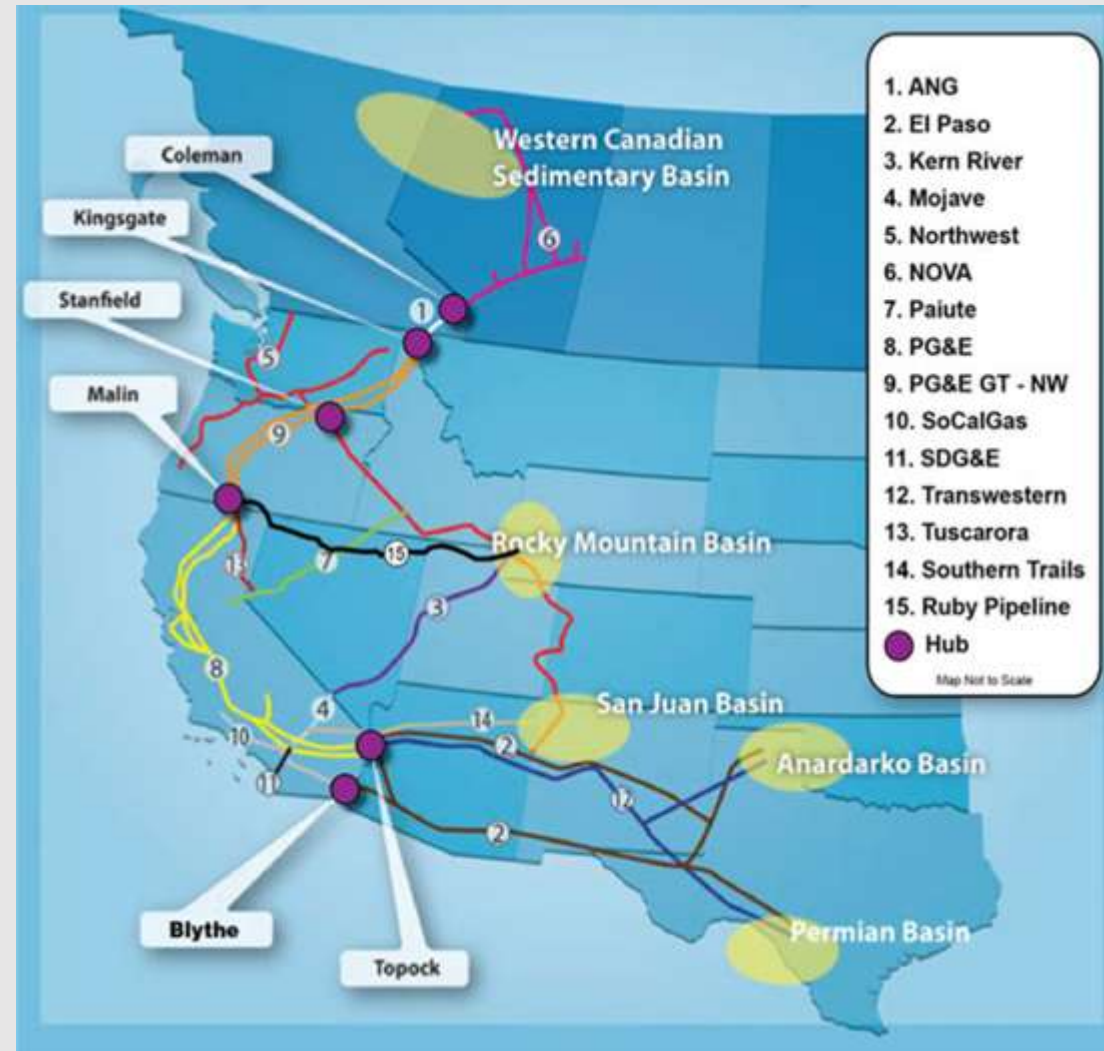
Wellhead to Burnertip



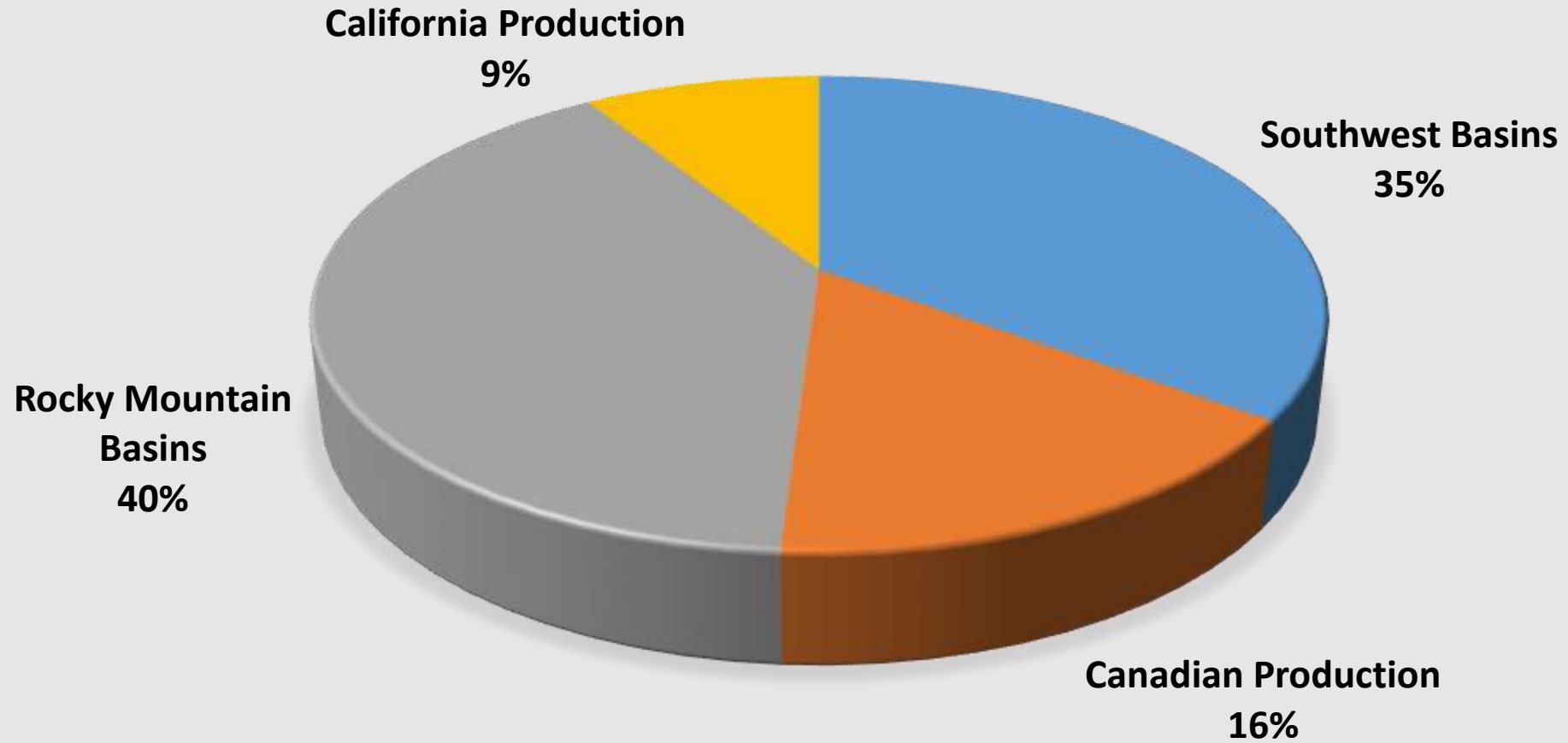
Pipeline & Storage Infrastructure



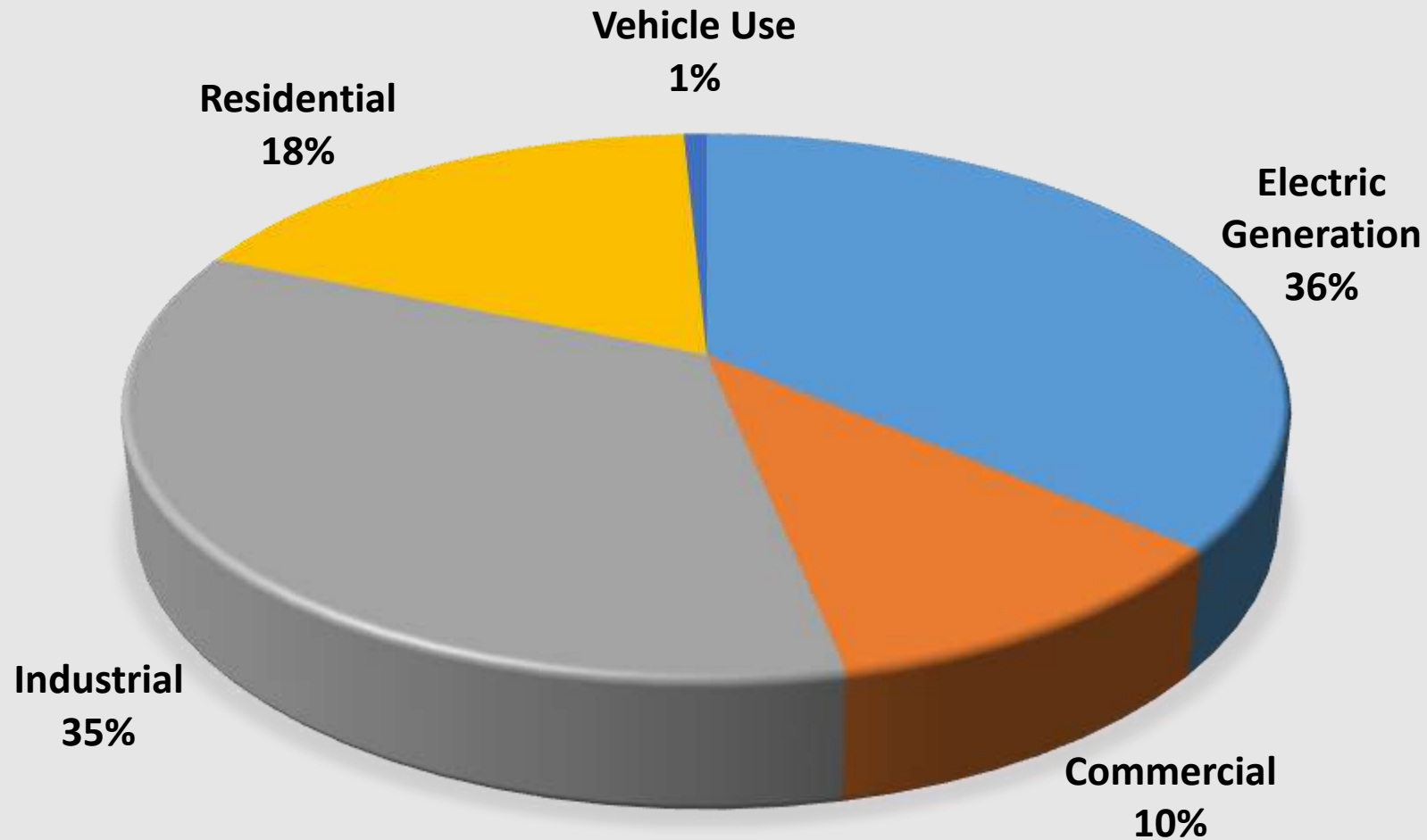
Interstate Infrastructure & Supplies



2012 California Supplies



2015 Consumption: 2.25 Tcf



Source: Energy Information Administration

Utility Service Territories



Natural Gas Regulation

PRODUCT/SERVICE	REGULATOR	PRICE REGULATION
Commodity Prices	FERC	No price regulation; market oversight and transparency
Interstate Transportation	FERC	Cost- and market-based rates
Interstate Storage	FERC	Cost- and market-based rates
Intrastate Transmission	CPUC	Cost-based rates
Intrastate Distribution	CPUC/Local Gov't	Cost-based rates
In-state Storage	CPUC	Cost- and market-based rates

CPUC Non-Price Regulation

Interconnection

Scope of Service

Safety

Market Rules

Priority of Service

Energy Efficiency

Balancing

Cap & Trade Admin

Public Purpose Programs

Use Limitations

Scheduling

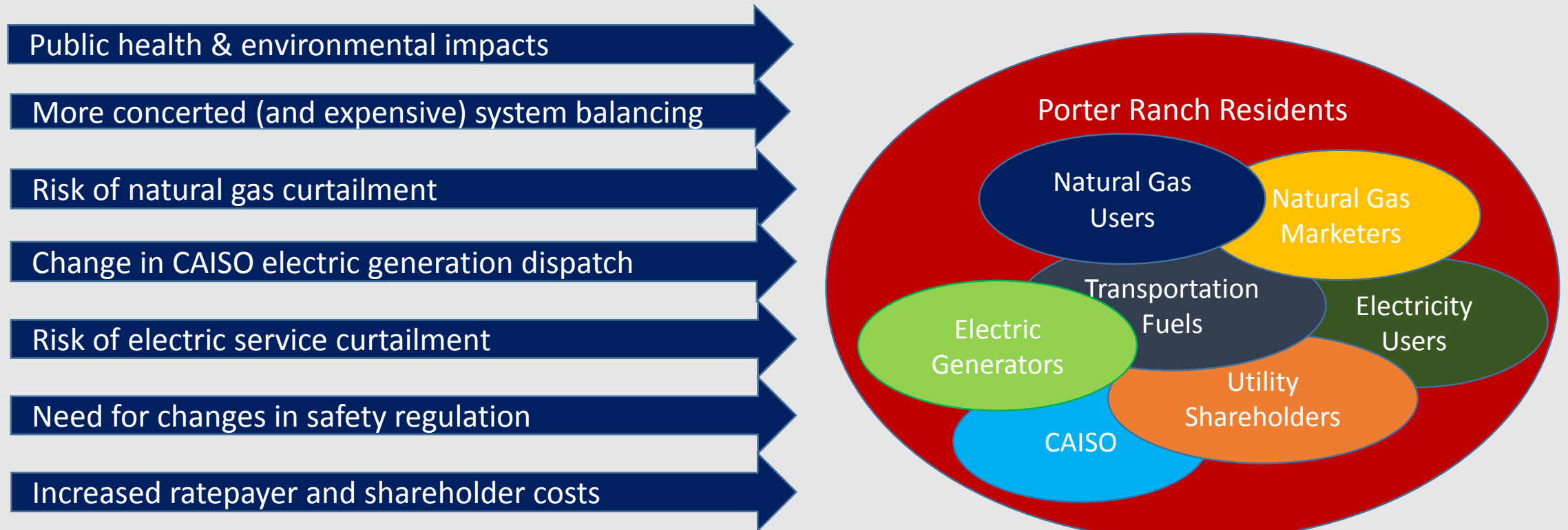
Safety Regulation

- Transmission pipeline safety is regulated by the Department of Transportation under the Pipeline Hazardous Material Safety Administration (PHMSA)
 - PHMSA is considering additional regulations for underground storage facilities
- CPUC regulates safety more broadly for SDG&E, SoCalGas and PG&E
 - Pipeline Safety Enhancement Plan Proceedings
 - Safety Model Assessment Proceeding
 - Risk Assessment and Mitigation Phase of General Rate Case Proceedings
- Department of Oil, Gas & Geothermal Resources has a safety role in permitting natural gas storage facilities and enforcing permit requirements.

It's All Connected

Aliso Canyon Storage Leak

Removed a critical storage asset from Sempra's system balancing toolkit with broad implications for the Southern California energy market



A Few of the Challenging Issues Facing California Regulators

- How can California ensure pipeline safety while maintaining reasonable rates for consumers?
- How should the CPUC and DOGGR work together to ensure storage safety, and should the federal government play a role with in-state facilities?
- Can the electric grid operate reliably with substantially reduced use of natural gas generation capacity, addressing both unanticipated outages and the increase of renewable resources?
- How much biomethane will be available to meet California's climate goals, and will the biomethane minimize stranding of utility infrastructure?
- As California drives toward zero carbon and natural gas usage declines, will utility infrastructure investment be stranded?

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