Methane to Markets Ministerial Meeting

November 15-17

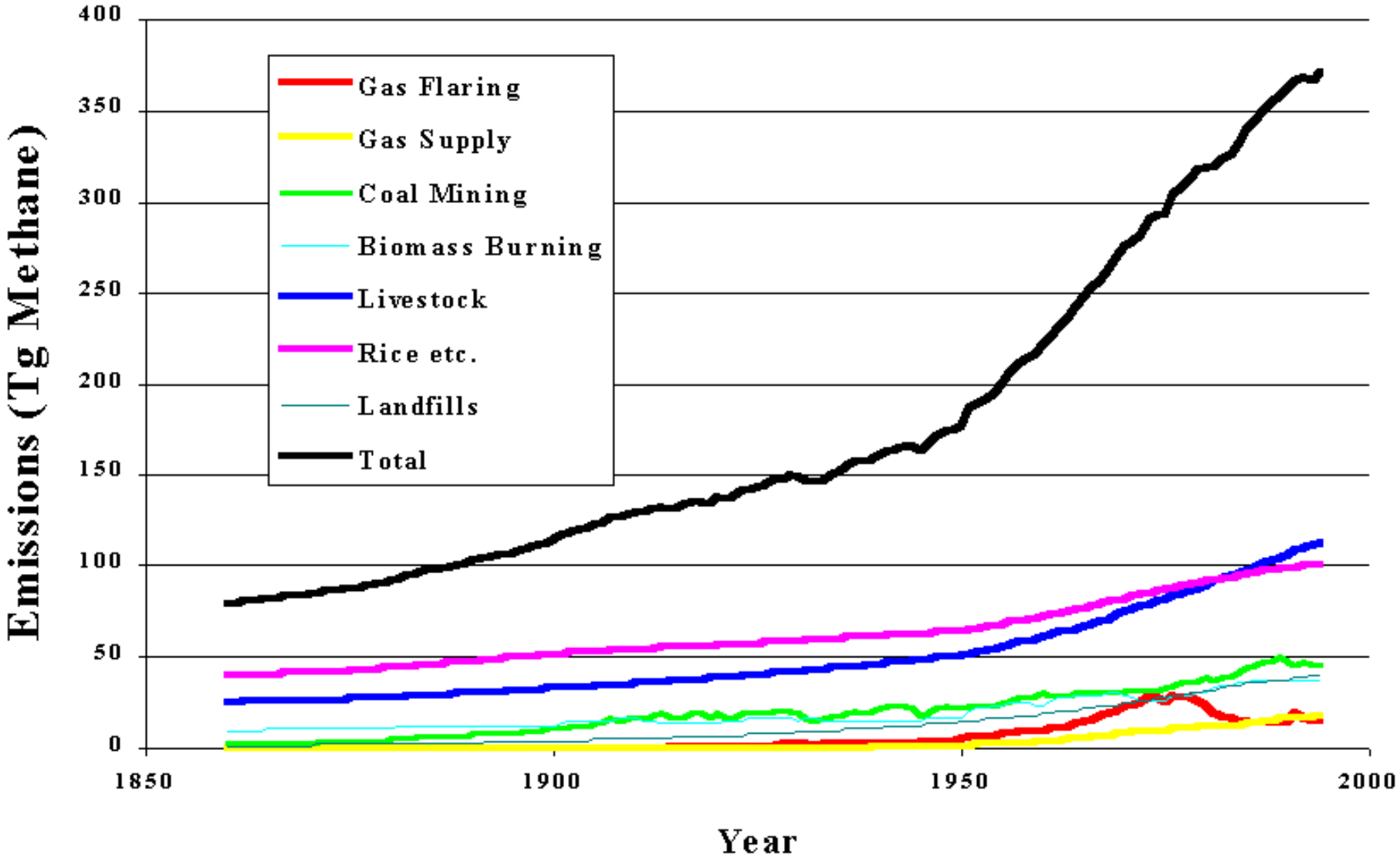
Washington, DC

Methane Emissions From the U.S. Natural Gas Industry
Quantification and Mitigation

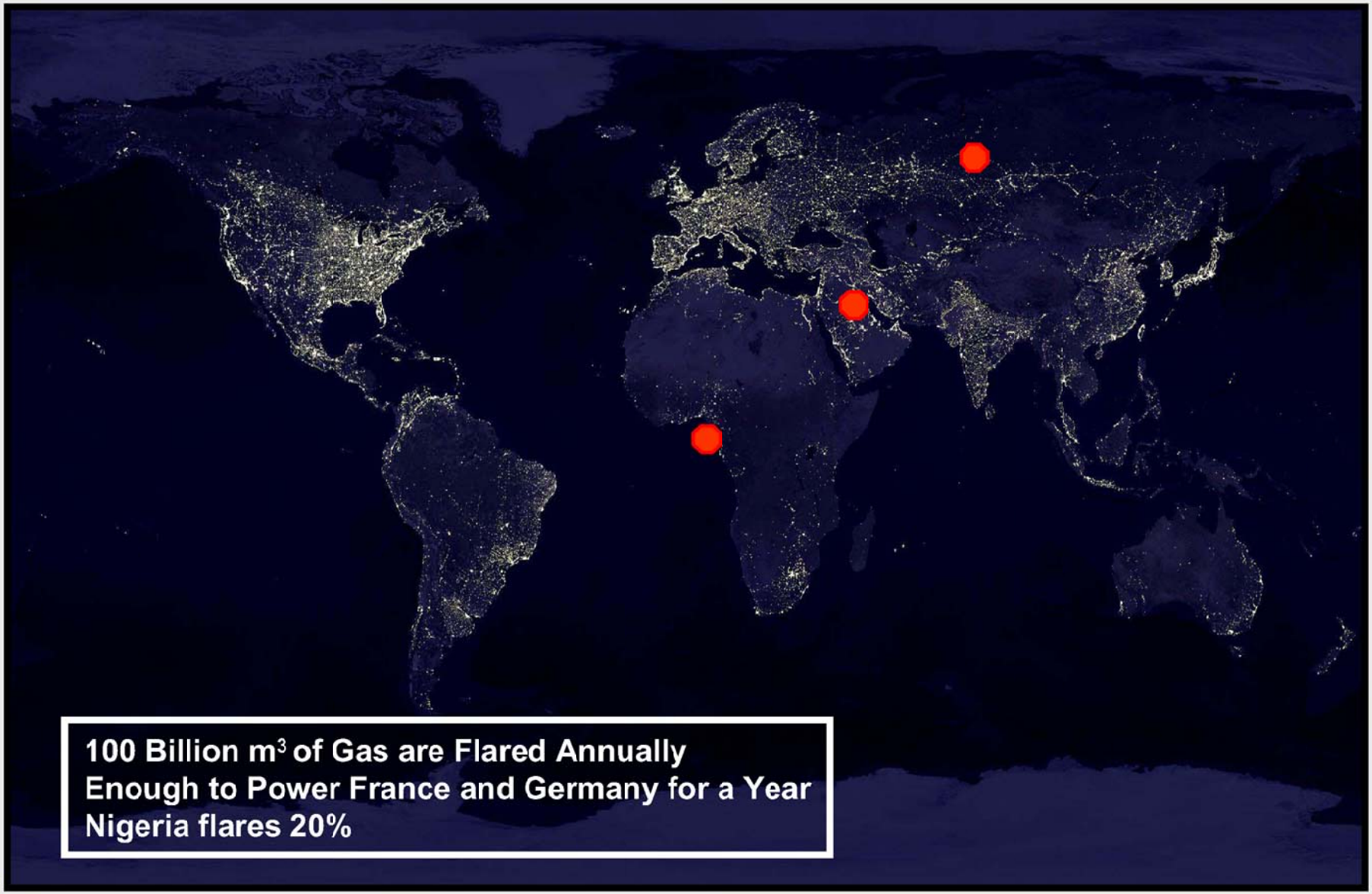
Dr. Robert Stokes

Gas Technology Institute

Global Anthropogenic Methane Emissions: 1860-1994
(Stern & Kaufmann)



World at Night



U.S. Gas Natural Gas Industry Methane Emissions

Overall Rationale

- **The increased use of natural gas has been proposed as a strategy to reduced global warming.**
  - **Less CO_2 per unit of energy consumed in combustion**
- **Some losses (releases) of methane (a potent greenhouse gas) occur during production and delivery of natural gas**
- **Critical questions:**
  - **Would increased utilization of natural gas substantially increase methane releases?**
  - **If so, what would be the net effect in terms of greenhouse gas releases?**

GTI Methane Emissions Program

- **Coordinated and cofunded program between GTI and USEPA**
- **Performance years of initial effort: 1991 to 1996**
- **Extensive Cooperation and Review**
  - **More than 30 energy companies**
  - **AGA**
  - **INGAA**
  - **USDOE and NOAA**
  - **National Labs**
  - **EPRI**

General Approach for Estimating Methane Emissions

- Identify and characterize each emission source within the industry
- All types of significant sources identified
- Include all sectors
  - Production
  - Gas Processing
  - Transmission / Storage
  - Distribution
- Estimate methane emissions among industry elements and rollup the totals
- Use “Global Warming Potential” (GWP) Calculations to Assess Impact of Using Natural Gas to Replace Other Fossil Fuels

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Global Warming Potential

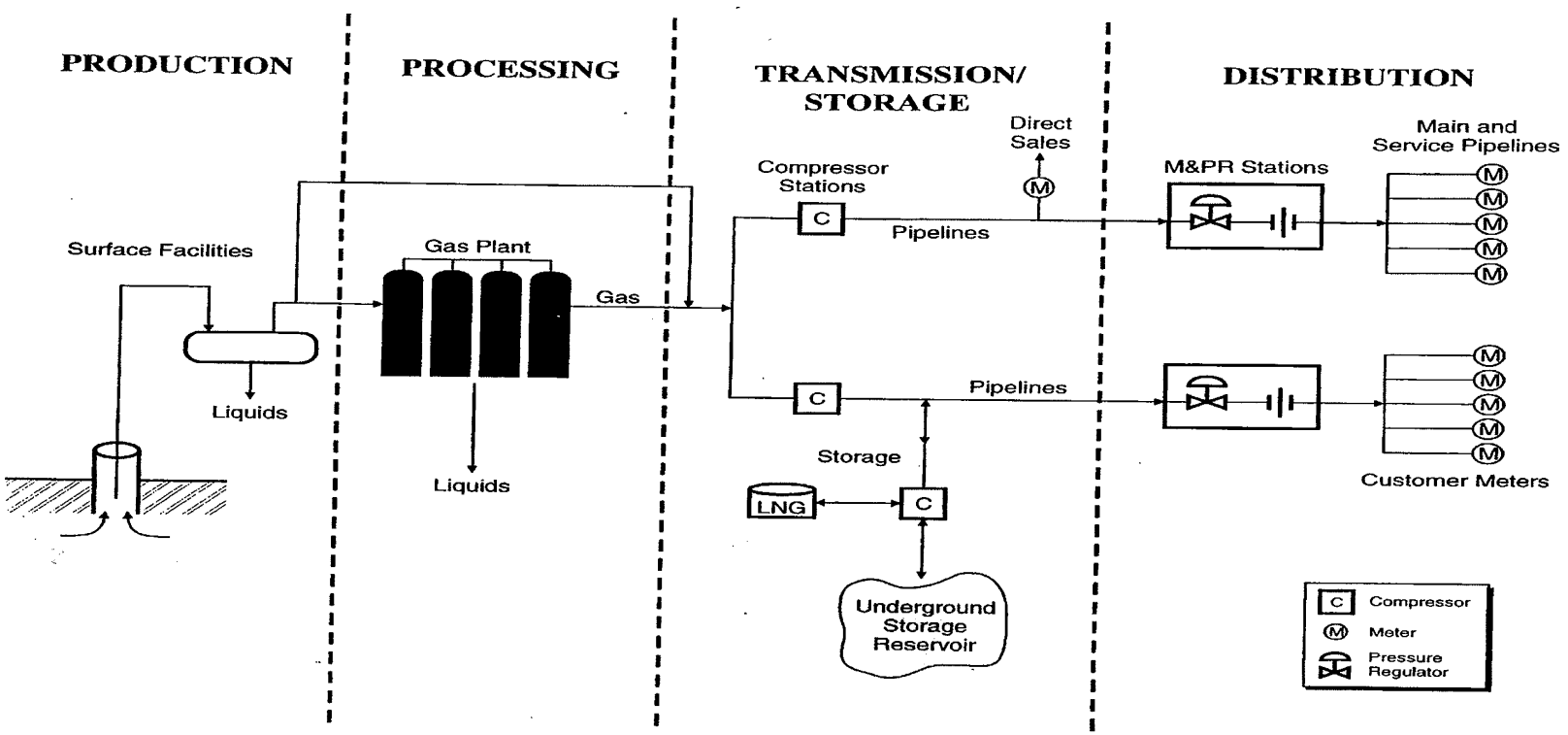
GWP = Impact of a Given Greenhouse Gas Compared to CO_2

- **Dependent upon the time period that is assumed**
- **Re: Methane has a shorter half-life than CO_2**

Time Period, yrs	GWP for Methane
50	34*
500	6.5

*** With an integration interval of 50 years, one pound of Methane has the impact of 34 pounds of CO_2**

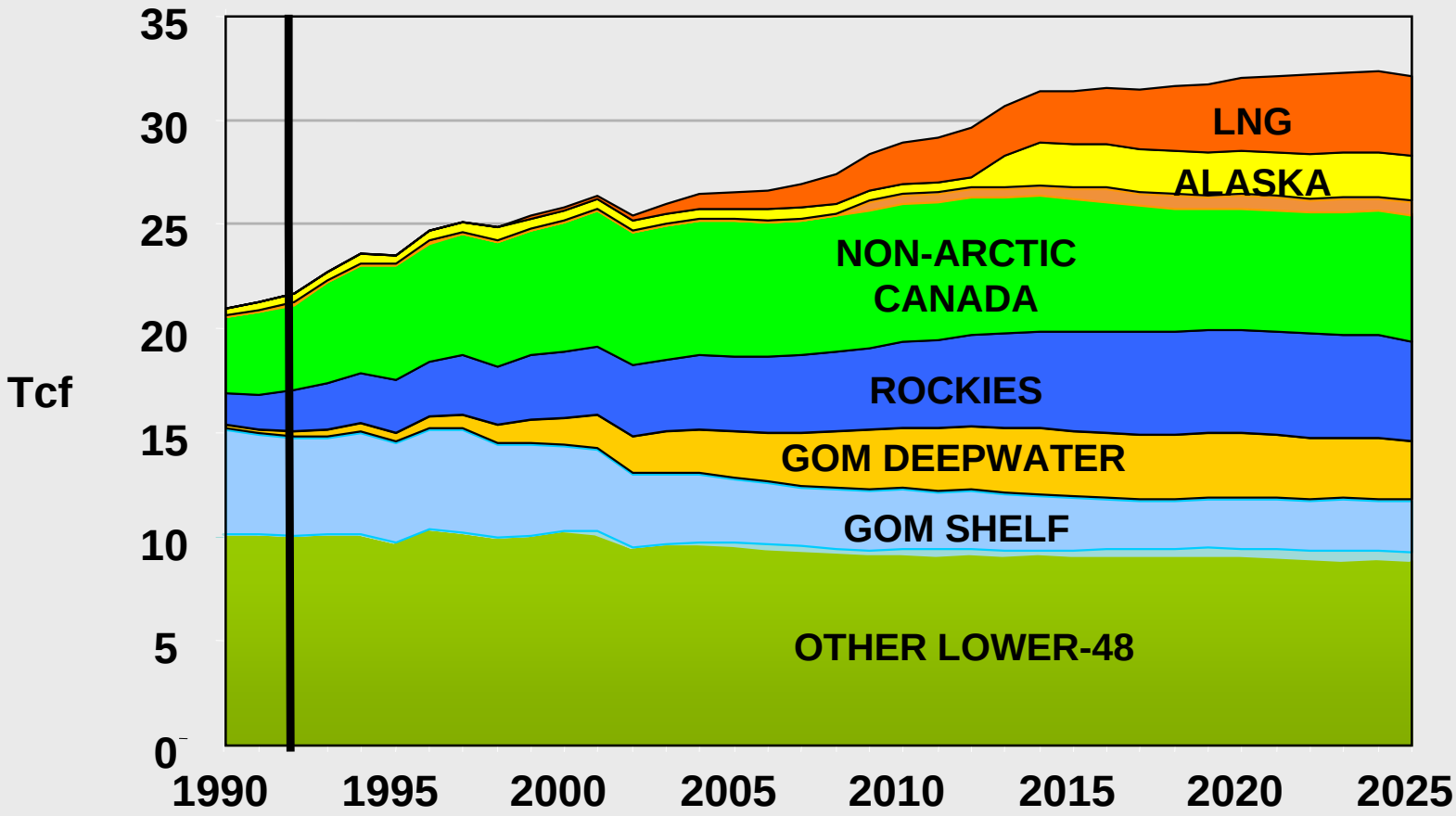
Generic Flow Chart for the Natural Gas Industry



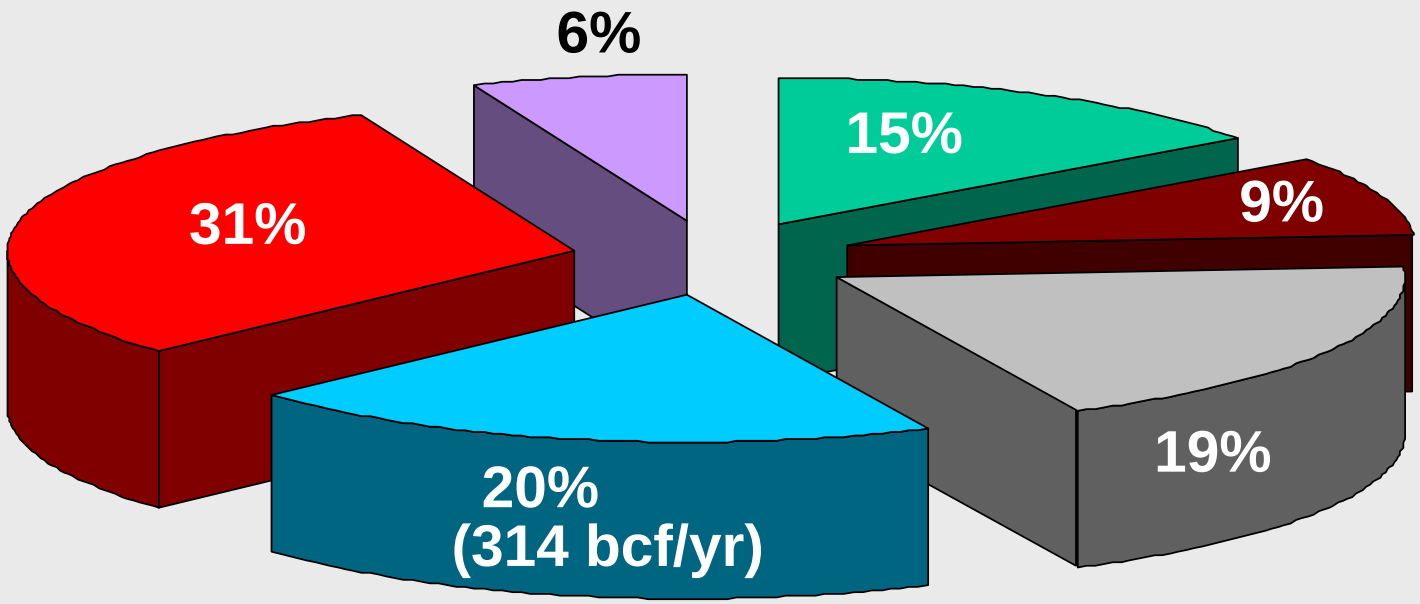
Summary of Methane Emission Estimates

- Methane emissions estimated to be 314 ± 105 bcf for the 1992 baseline year
- This represents 1.4 ± 0.5% of gross natural gas production
- The majority of methane losses in the natural gas industry are due to fugitive emissions

Future Supplies Come from Traditional and New Sources



Contribution of Major Methane Sources to Total U.S. Anthropogenic Emissions*



* Total = 1,570 bcf per year

- Coal Mining
- Livestock Manure
- Domesticated Livestock
- Natural Gas Industry
- Landfills
- Other

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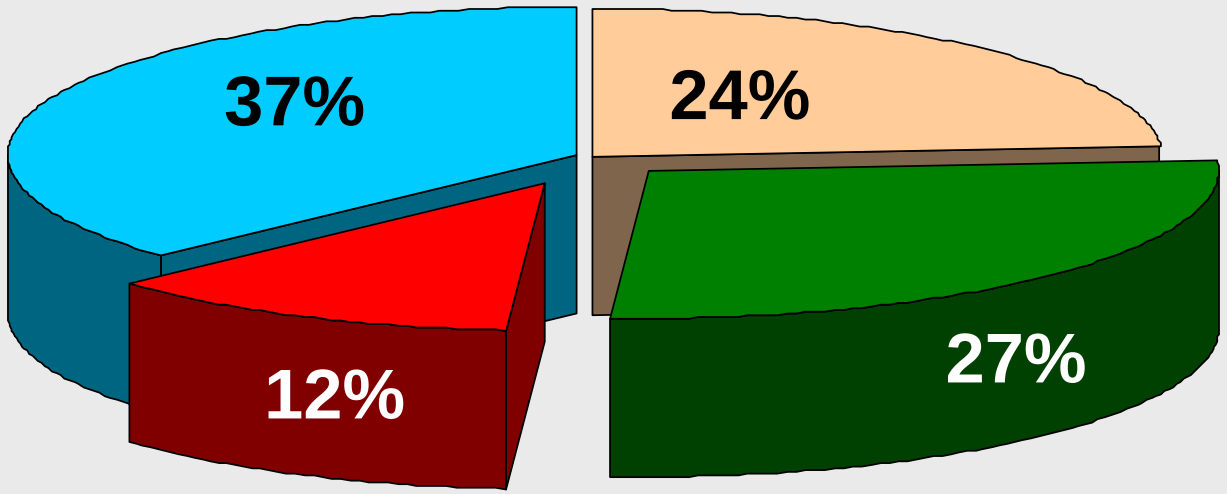
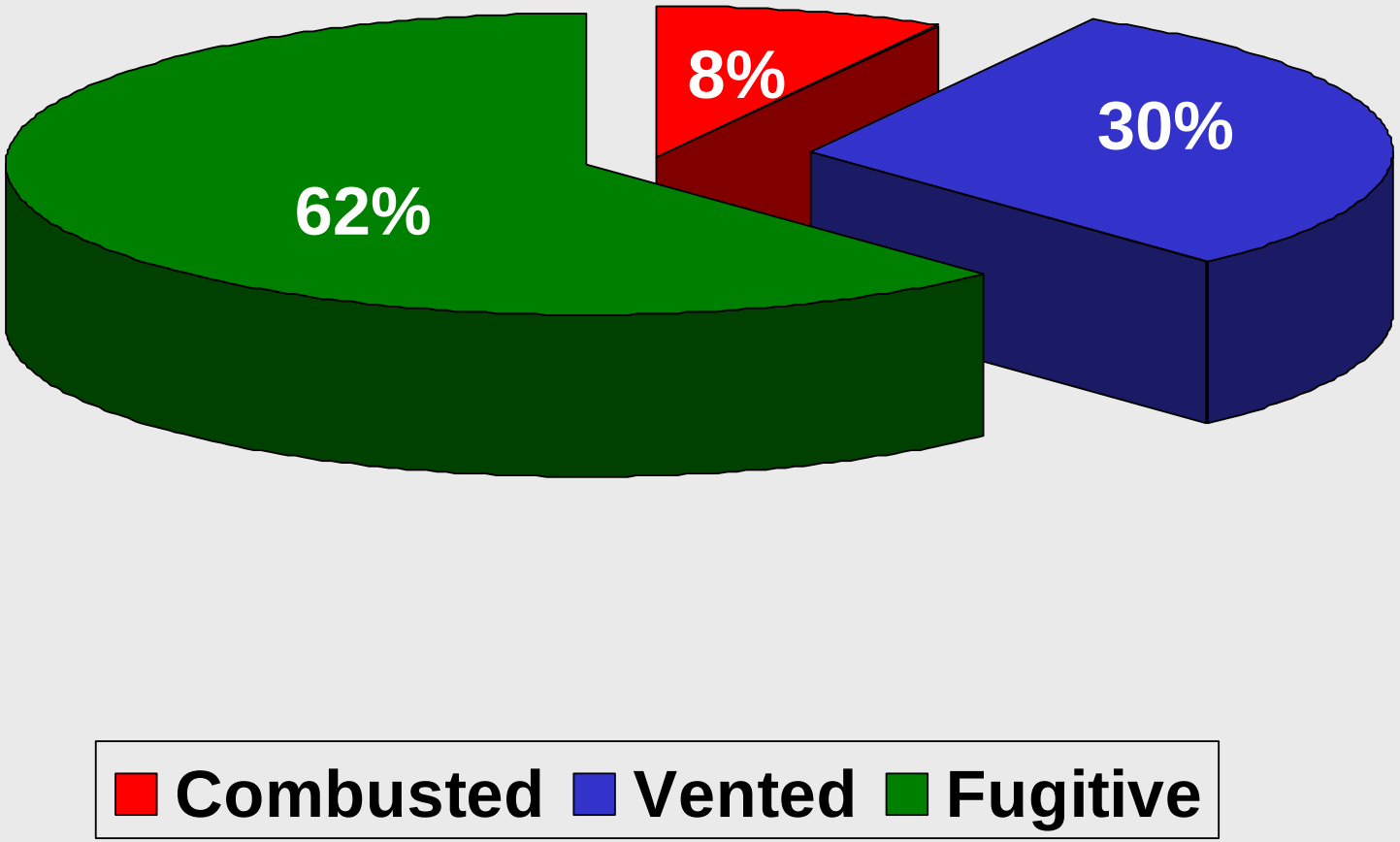
Natural Gas Methane Emissions Across Industry Sectors *



* Total Natural Contributions = 314 bcf per year

Methane Emissions from the Natural Gas Industry by Type



Major Types of Sources in Each Sector

Sector	Sources
Production	Pneumatic Devices Fugitive Emissions Dehydrators
Gas Processing	Fugitive Emissions Compressor Exhaust
Transmission & Storage	Fugitive Emissions Blow and Purge Pneumatic Devices Compressor Exhaust
Distribution	Underground Pipeline Leaks Meter and Pressure Regulating Stations Customer Meters

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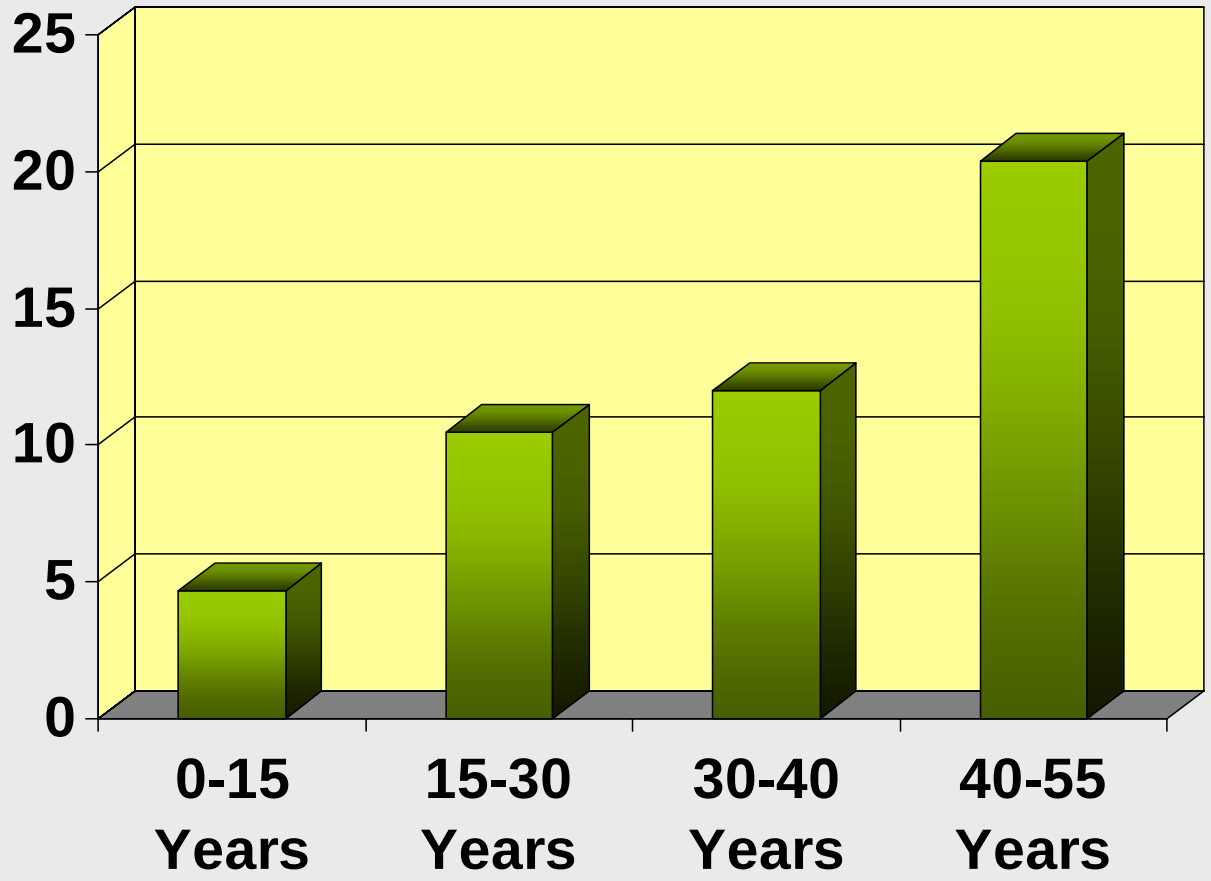
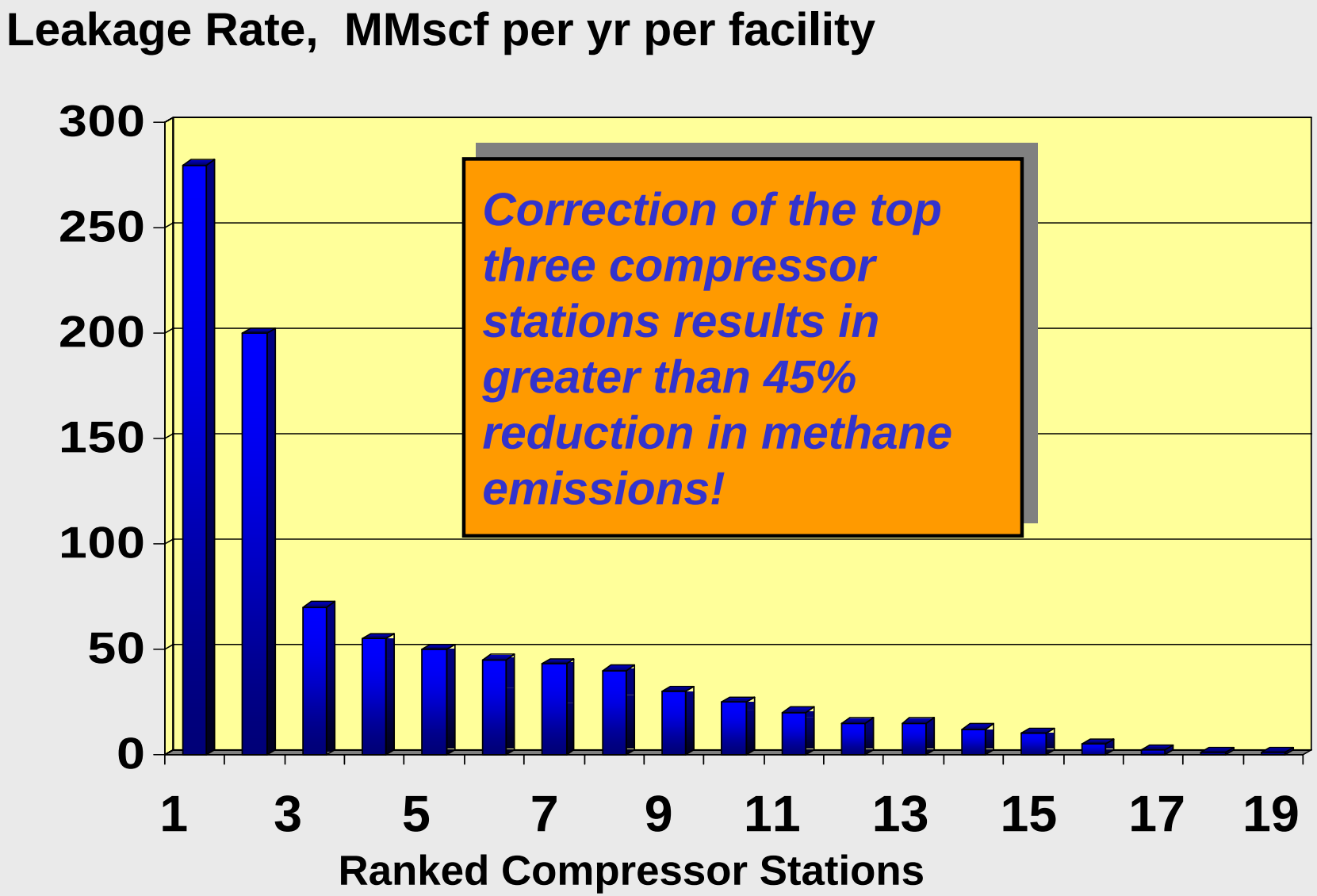
Leakage Rate Versus Age for U.S. Compressor Stations



Leak Rate per Engine

Example of Emissions Ranking from the Compressor Stations of a Single Transmission Company



Examples of the Impact of Preventive Maintenance

Equipment Component	Action	Impact
Compressor Engine	Tightened the cylinder head	64,000 Mscf/yr → 3,250 Mscf/yr Savings: $121 K/yr
Tube Fitting, ½ inch	Five minutes of repair work	4,100 Mscf/yr → 10 Mscf/yr Savings: $8,200/yr
One-inch Fuel and Gas Pressure Relief Valve	Five hours of repair and $125 of new parts	36,800 Mscf/yr → 104 Mscf/yr Savings: $73,500/yr

Comparison of Equivalent CO_2 Emissions Among Fuel Types

Fuel Type	Lbs CO_2 / mmBtu		Equivalent CO_2 Ratios	
	GWP 6.5	GWP 34	GWP 6.5	GWP 34
Natural Gas	132	152	1.0	1.0
Fuel Oil	184	186	1.4	1.2
Coal	212	228	1.6	1.5

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Summary

- Methane emissions estimated at 314 ± 105 Bscf/yr for the baseline year of 1992
- Natural gas industry represents about 20% of the total anthropogenic methane release
- Fugitive methane emissions are 62% of the natural gas contribution
- Increased use of natural gas to displace other fossil fuels yields a substantial net reduction in greenhouse gas impacts.
- Joint GTI / USEPA publications resulted in recommendations that identify significant opportunities for emissions reductions and savings for the industry.