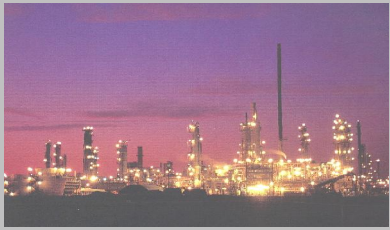


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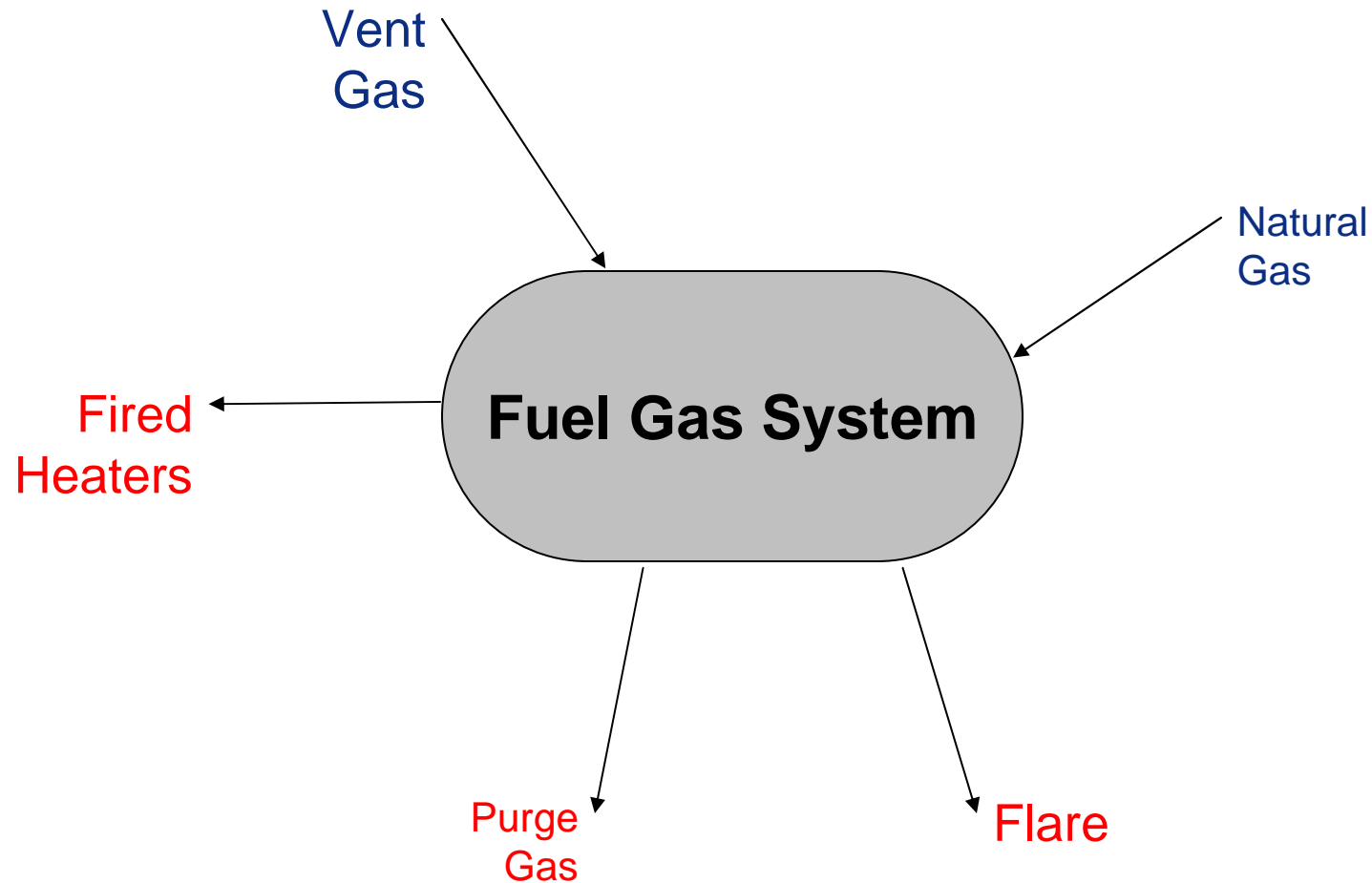
The Fine Art of Fuel Gas Management

September 2008

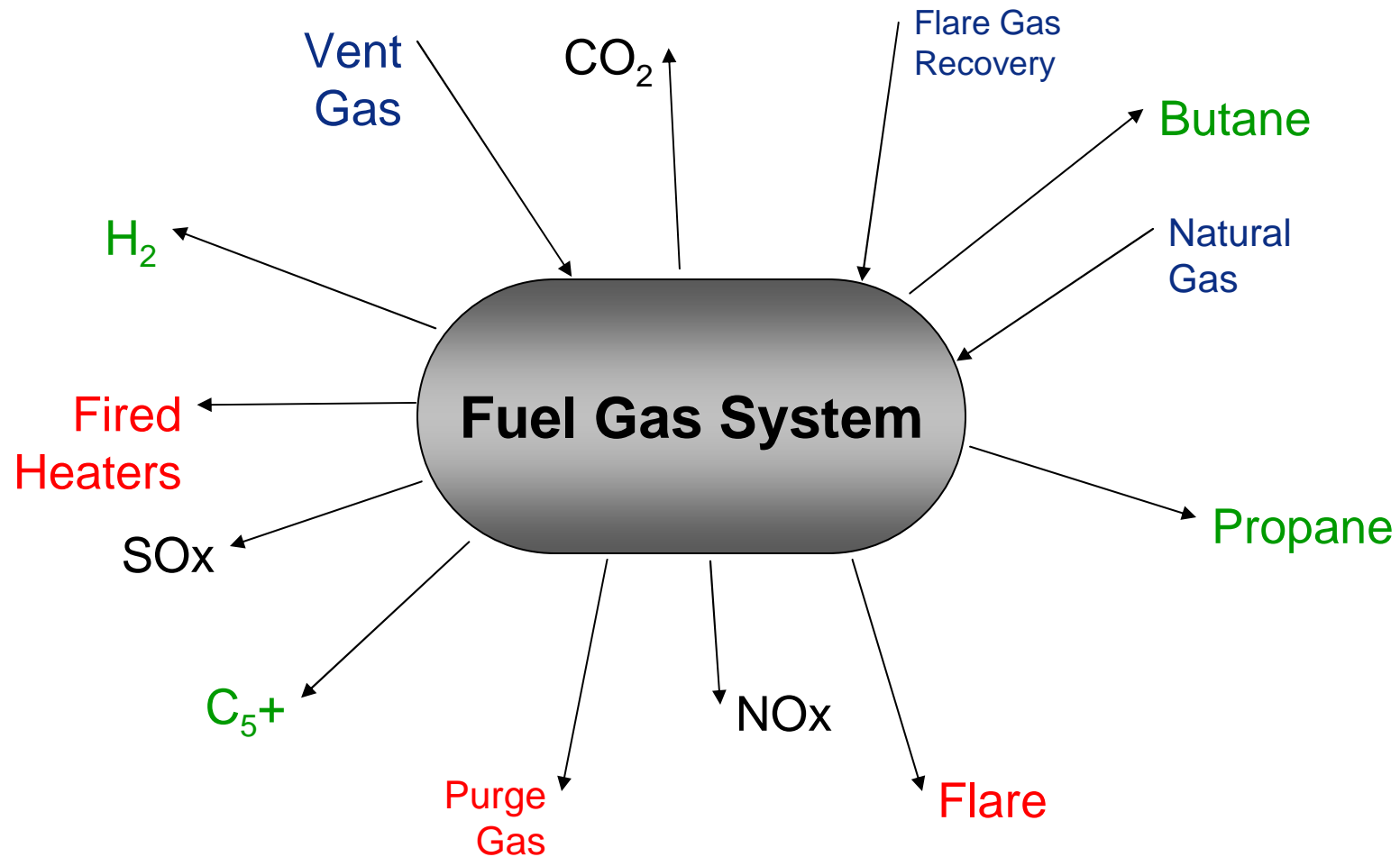
Christopher Vogel

Jacobs Confidential

What's the big deal?



The WHOLE Picture



Agenda

- Regulations and Timing
- Impact and Issues
- Planning for the future
- Defining the solutions
- Jacobs Experience and Qualifications

Regulations and Timing

- Current
 - NSPS subpart J
 - Fuel Gas: <162 ppm H₂S based on a 3 hour rolling average
 - Consent Decree
 - NO_x limitations on Fired Heaters



Regulations and Timing

- Pending
 - New Source Performance Standards (NSPS) Subpart Ja
 - EPA final regulations issued June 2008
 - Multiple areas of impact across the refinery
 - FCC Flue Gas
 - Fuel Gas
 - <60 ppm H₂S based on 365 day rolling average
 - Flare
 - No “on purpose” flaring, including start-up and shutdown
 - Timing: Any projects started after May 14, 2007
 - CO₂

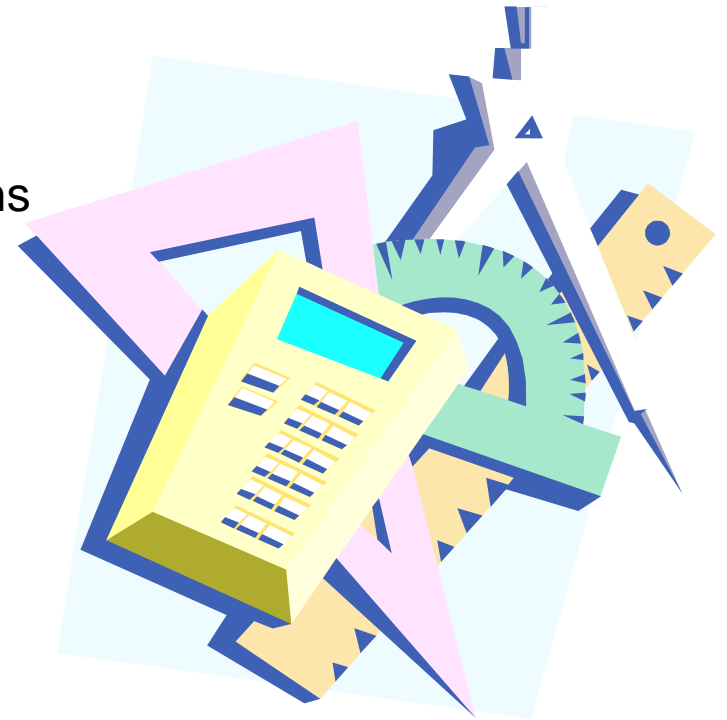
Impact and Issues

- Understanding current baseline
 - Fuel Gas balance and properties
- Processing change options
 - Optimization
 - Reconfiguration
- Secondary effects: hydrogen balance, flare system, LPG recovery, “Decarbonization”, others
- Future projects



Understanding the Baseline

- Current situation
 - Source of fuel gas streams
 - Composition of fuel gas streams
 - Sulfur speciation of various fuel gas streams
 - Heater constraints
 - Facility hydrogen balance
 - CO₂ footprint
- Planning tools
 - Calibration of process models and LP
 - Ability to predict and respond to process changes and operating severities



Jacobs Consultancy Approach

Opportunities Identification

- Understand current situation and baseline
- Identify site specific market opportunities
- Define feasible technical alternatives
- Screen alternatives through critical failure analysis
- Preliminary modeling and economics
- Output: recommended best strategies / options for further evaluation

Configuration Options

- Hydrogen recovery
 - Site specific hydrogen situation
- Propane and heavier recovery
 - Site specific market opportunities
 - Gasoline blending opportunities
- Other alternatives including export of fuel gas
 - Utility agreements

Jacobs Consultancy Approach (cont.)

Conceptual Design

- More detailed configuration analysis and production balances
- Technology selection (and licensor selection as appropriate)
- Overall refinery impact:
 - Refinery networks (hydrogen, fuel gas)
 - Off-sites
 - Compliance (environmental, OSHA, etc)
- Preliminary cost estimate
- Economic and risk analysis (regulatory and other uncertainties)
- Preliminary implementation strategy

Technology Selections

- Sulfur removal (H₂S, Mercaptans, COS, CS₂, Di-sulfides)
 - Caustic
 - Lean Oil
 - Amine Upgrades
- BTU management
- Hydrogen technologies
- C₃+ Recovery
 - Current system Fractionation/Recovery Improvements
 - Cooling system improvements
 - Cryogenic removal
- “Decarbonization”

Jacobs Consultancy

Experience and Qualifications

- Extensive involvement in utility evaluations and projects over the last 10-15 years
- Multiple fuel gas and utilities studies
- Numerous refinery reconfiguration studies
- Assisting in Execution of a number of recent fuel gas projects
 - Fuel Gas study @ West Coast refinery
 - Fuel Gas Treater study @ East Coast refinery
 - Fuel Gas Management study @ Central US refinery

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Experience and Qualifications (cont.)

- Technology expertise and involvement with all potential processes
 - Associated units (Crude, Coker, FCC, Reformer, Hydroprocessing & Hydrocracking)
 - C3+ removal
 - Hydrogen removal
 - Sulfur technologies
 - CO₂ technologies
- Refinery modeling
 - Variety of tools used including LP, PetroPlan, HYSYS, and others
 - Process unit yield and quality representations
 - Proprietary rigorous process simulation models
- Cost estimating
 - Ability to estimate “total project costs”: ISBL and OSBL
 - Integration with Jacobs Engineering expertise



Any questions?