



Energy Advantage with Light Hydrocarbons Furnace Fuel Flexibility

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Track J: Better Plants Program

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Why are we here presenting...

- To share a little about how our team came together to make more efficient use of Plant Produced Fuel Gas (PPFG) with our anticipated move to lighter feed slates
- To let our Hydrocarbons and Energy peers know what kind of results are possible

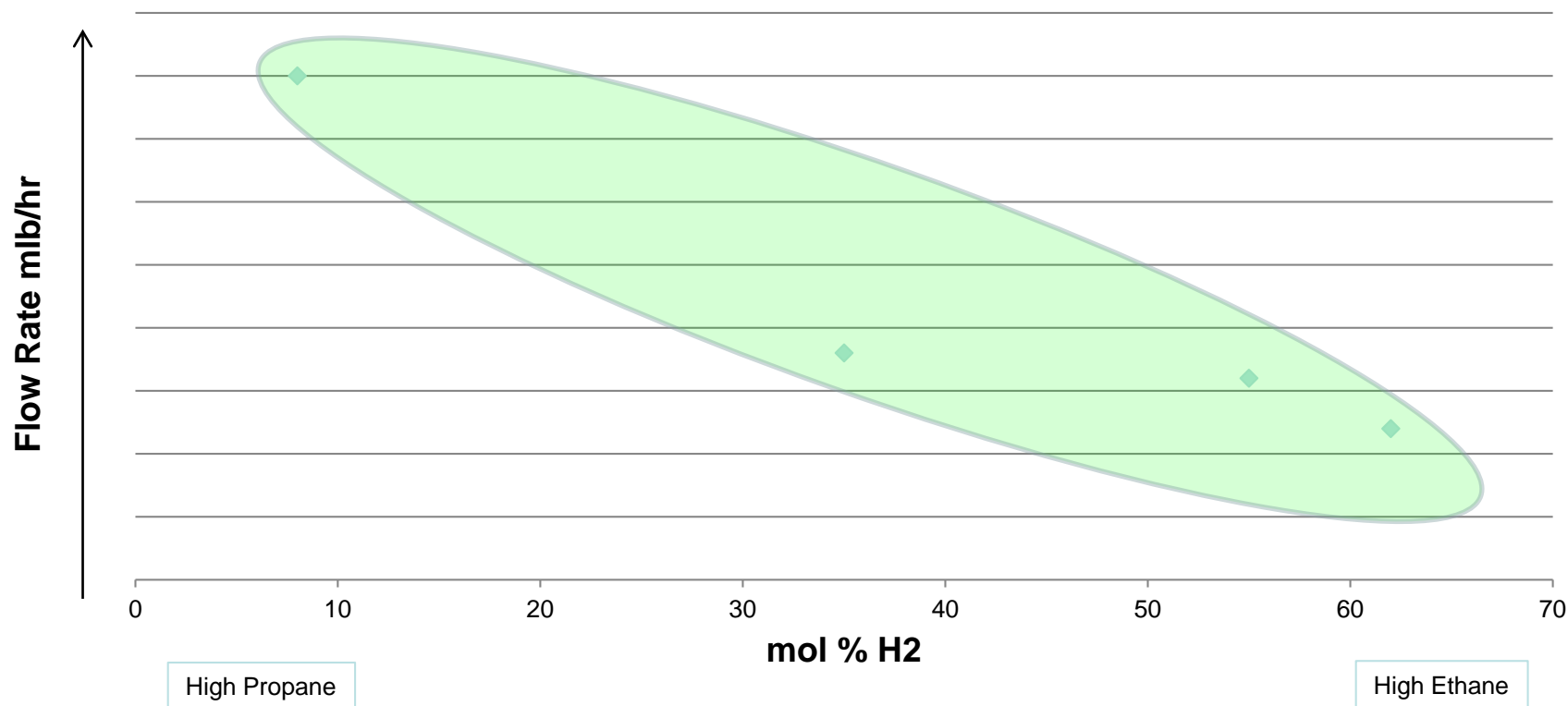
A little bit about making Ethylene

- A **Cracker** is a chemical complex in which gaseous and/or liquid feedstocks are converted, primarily into ethylene.
- **Feedstocks** (primarily Ethane and Propane) enter a furnace and are exposed to heat (near 1500 deg. F) which results in “cracking” larger molecules into smaller molecules of ethylene, propylene, and other molecules mixed together.
- The resulting gaseous molecules enter a compressor and cold box and are then processed through a series of distillation columns for separation.
- Once distilled, large quantities of products such as ethylene, propylene, methane and hydrogen are produced.

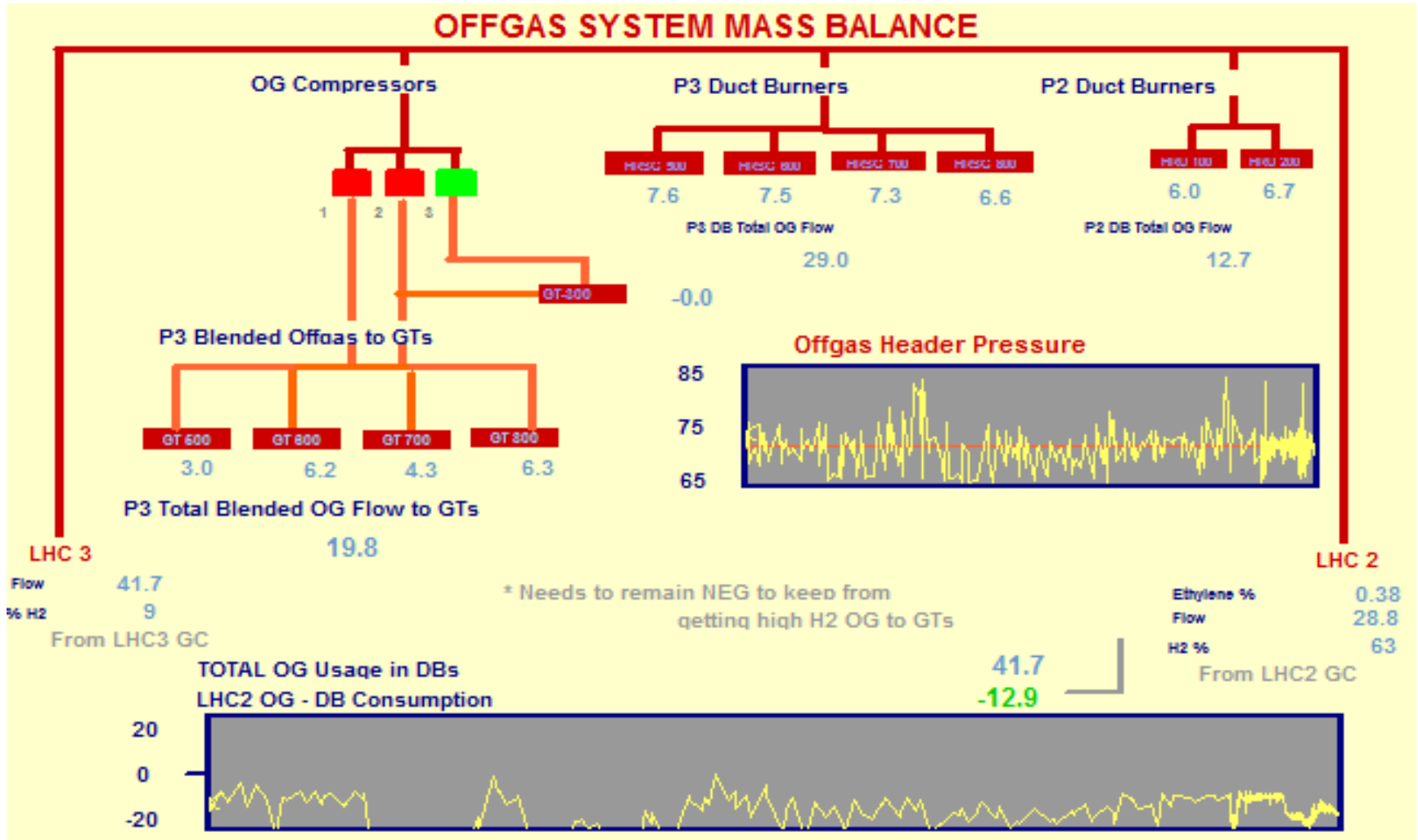
Reference: <https://www.youtube.com/watch?v=lud7nXxlzuA>

Lighter feed slates and resulting PPFG

PPFG Export from LHC



Here's an overview of our site configuration



Plant Produced Fuel Gas (PPFG) challenges

- Must consume all PPFG
 - Not permitted to flare year-round
 - Inefficient to flare
- Gas Turbine blending limited to 5 mol% H₂ total
- Gas Turbine blending valves lower flow limit at 2.7 mlb/hr (~52 mol% H₂)
- Duct burners limited to 62 mol% H₂ due to potential flame impingement on first row of Heat Removal Steam Generator superheater tubes
- More economical to blend into Gas Turbine than to duct fire and condense on steam turbines
 - CCHR of 7.4 mmbtu/MW on GTs
 - DBHR averages 9.8 mmbtu/MW

Several options were evaluated...

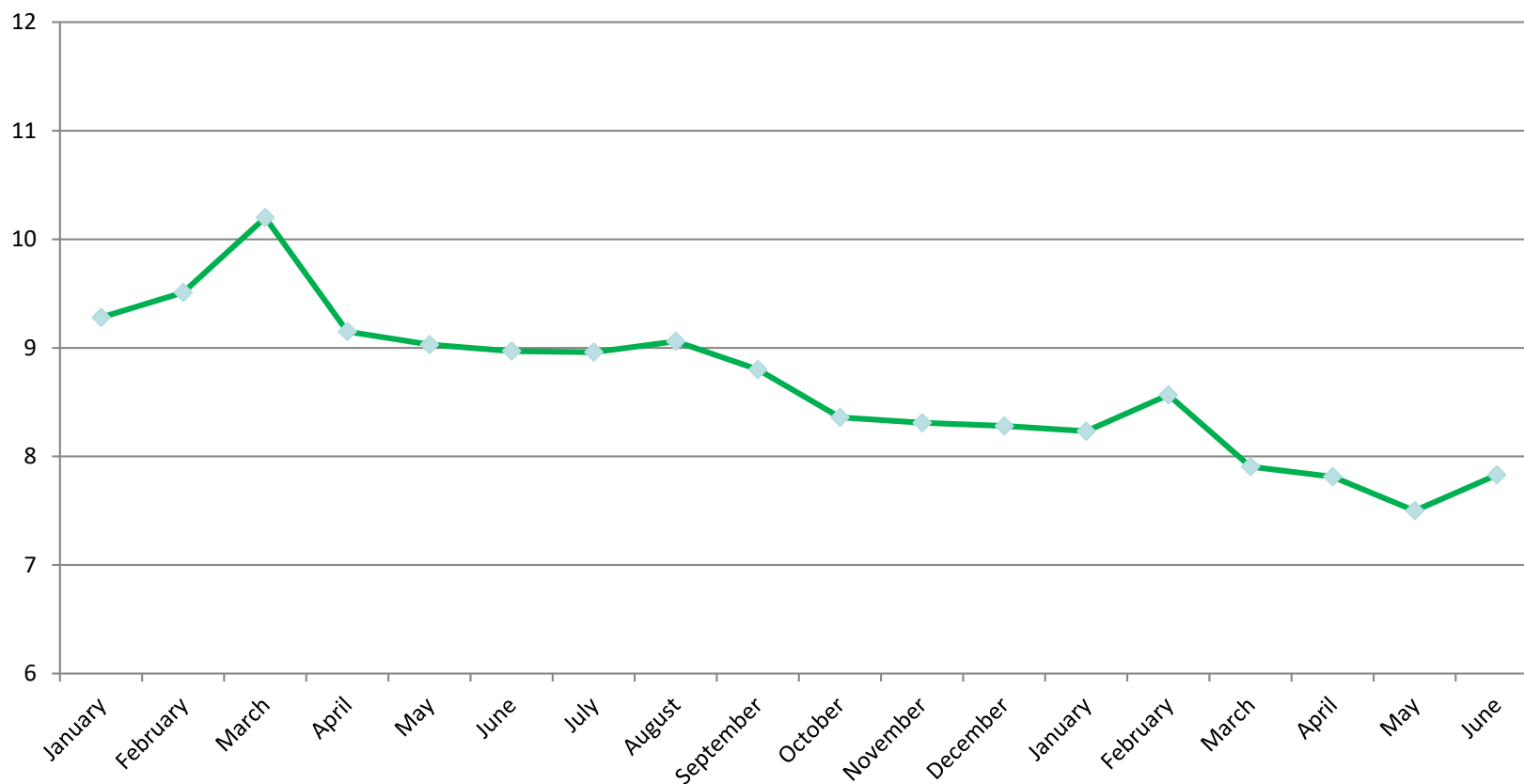
- Flame Sheet Technology on GE 7FA GTs
- Increased PPF_G H₂% blending allowance on GE 7FAs
- Blending Natural Gas into High H₂ PPF_G at LHC before exporting to Energy Systems
- ✓ New furnace burners to preferentially burn higher H₂ PPF_G stream at LHC

New burner tips for our largest furnace

- This project installed new burner inserts for the 72 secondary wall burners, redesigned for high hydrogen firing, replacing the original burners.
- Modified premix gas tip for H₂ concentrations up to 80%.
- Reduced flow area to increase fuel velocity.
- Spring loading of the premix tip to prevent the space between the disks from opening up due to thermal growth.
- New line-ups were established to preferentially burn the higher H₂ PFFG stream in the modified furnace consuming the bulk of this PFFG and making the remainder more manageable.
- Took approximately 2 weeks of installation time during scheduled outage.

Our result – improved site heat rate

**SITE HEAT RATE
(MMBTU/MWeqv)**



A new and better way of operating...

- LHC can now burn more of their own PPF_G, resulting in 40 mlb/hr less PPF_G exported to Energy Systems and at substantially lower H₂ concentrations.
- Energy Systems can blend all of this PPF_G into GTs with only minimal duct firing.
 - Site Heat Rate has improved by 0.98 mmbtu/MWeqv.
- Reliably meeting the same site power and steam demands, but much more efficiently

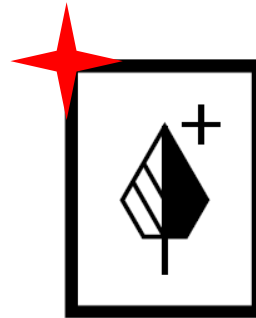
Energy efficiency in its purest form...

- 1 year of operation since new burner tip installation
- Represents an 11% improvement in energy efficiency
- 5970 BBTU reduction in first year of operation
- 350K Tons of CO₂ emissions reduction/yr

DOW PROUD!

Delivering strong on several of our Dow 2025 Sustainability Goals...

VALUING NATURE

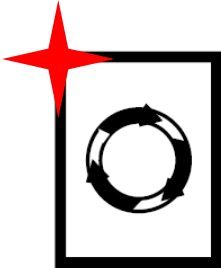


Valuing Nature

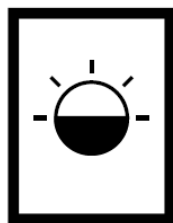
COURAGEOUS COLLABORATION



Leading the Blueprint

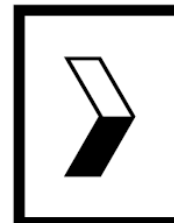


Advancing a Circular Economy

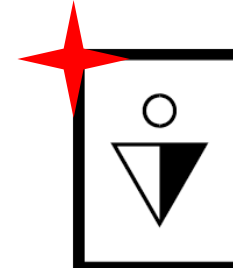


Increasing Confidence in Chemical Technology

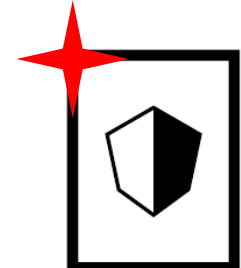
UNLOCKING THE POTENTIAL OF PEOPLE & SCIENCE



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QUESTIONS?