

Mobilizing Gas Turbine Units to Reduce Flaring

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Reminder : what is a gas turbine ?

- A Heavy Duty GT is a single shaft turbo-machine with:
 - 1 compressor, 1 combustion system, 1 expansion turbine

Compressor

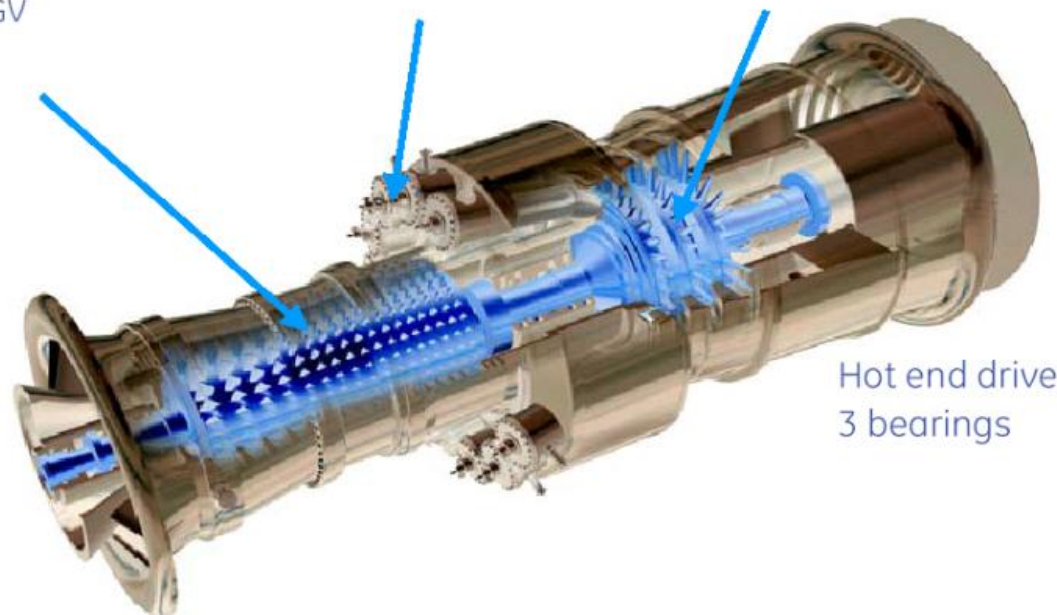
- 17 stage axial flow
- 12.6:1 pressure ratio
- 1 row IGV

Combustion system

- 14 can annular chambers
- Standard or Dry Low NOx

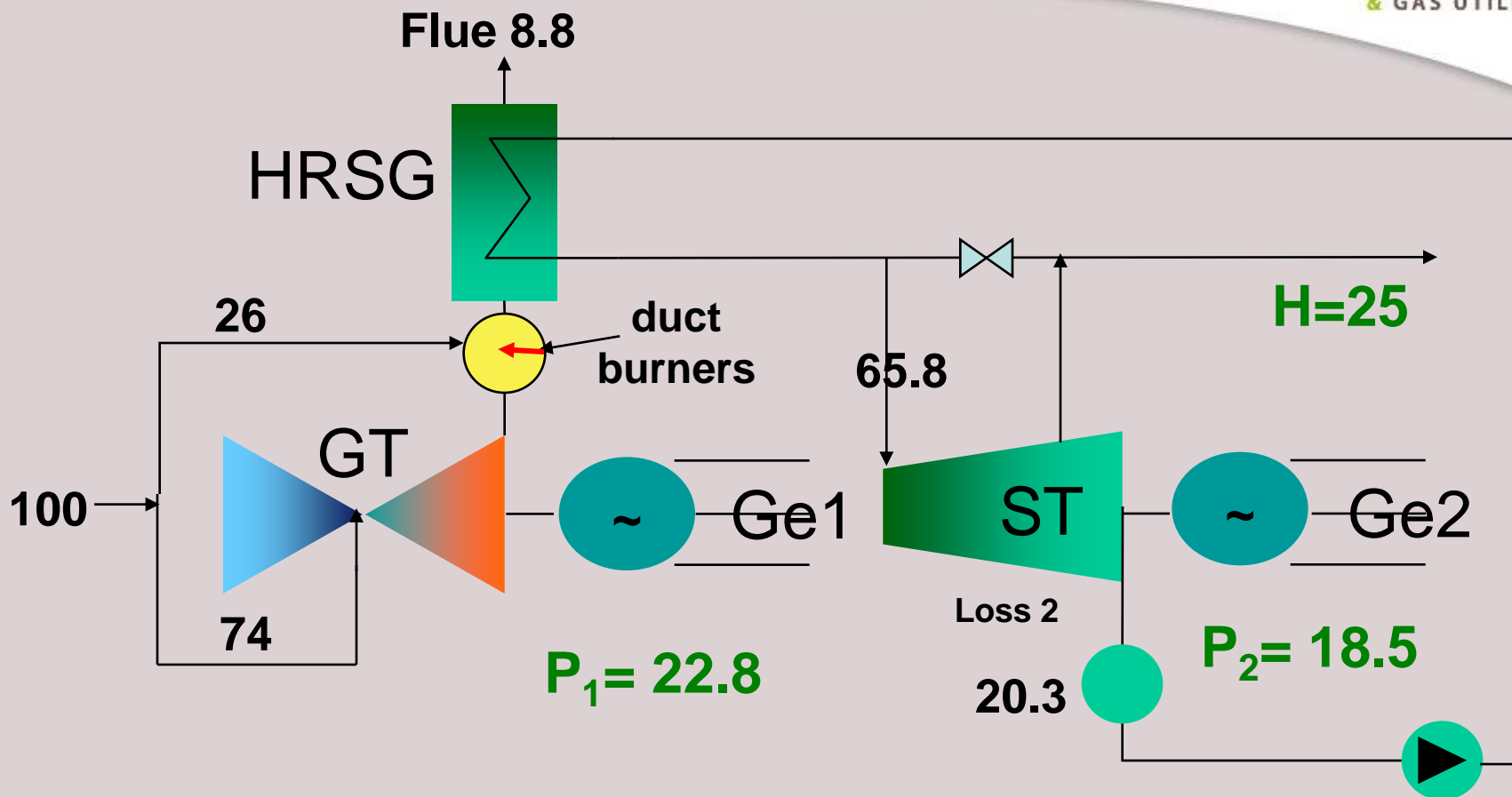
Turbine

- 3 stage high efficiency
- Through bolted construction



Hot end drive
3 bearings

Cogeneration (CHP) Principles

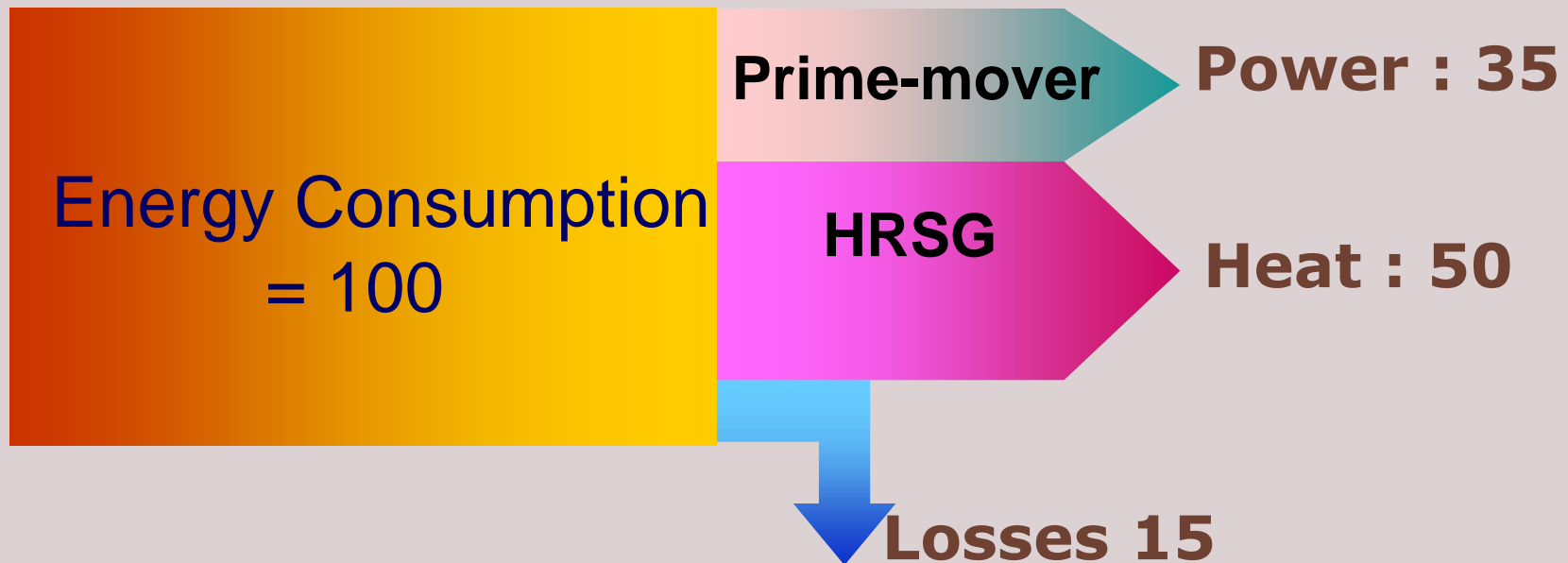


Case with postcombustion; $P = P_1 + P_2$, $P/H = 41.3/25 = 1.65$
 $\eta = 66.3\%$ - $\eta_{EE} = 56.5\%$

Minor losses are not represented

GT are best efficient in Cogeneration

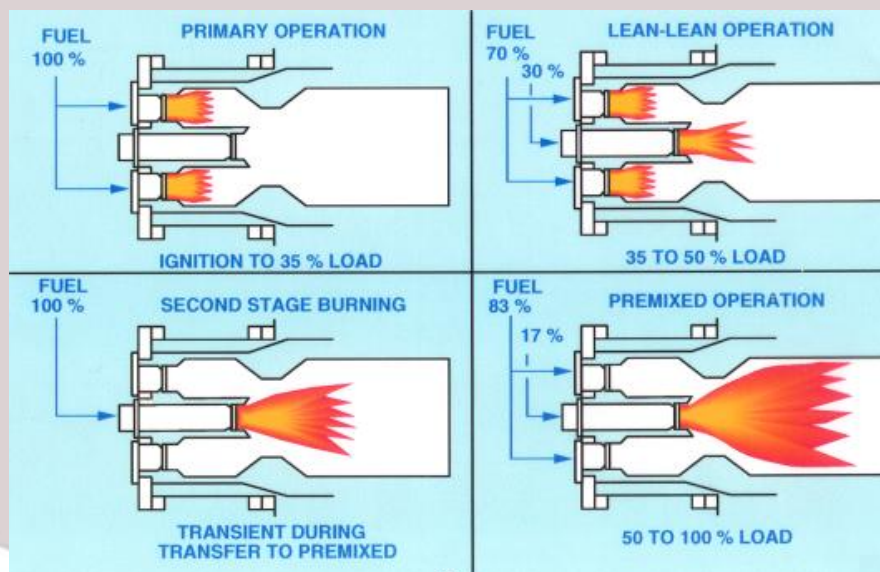
Example with Power / Heat ratio (P/H) = 0.7



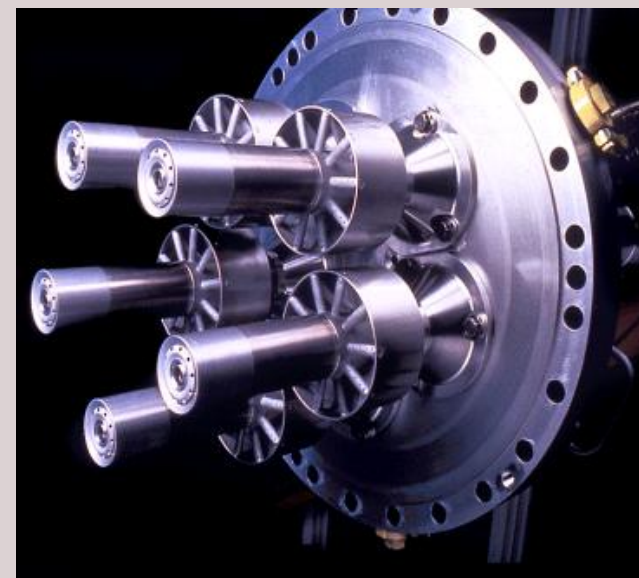
Total Efficiency : 85%

Environmental friendly combustion

- GTs meet increasingly stringent emission regulations
 - The gas turbine industry has developed high level standards for emission incl. dry low NO_x & deNox by steam/water



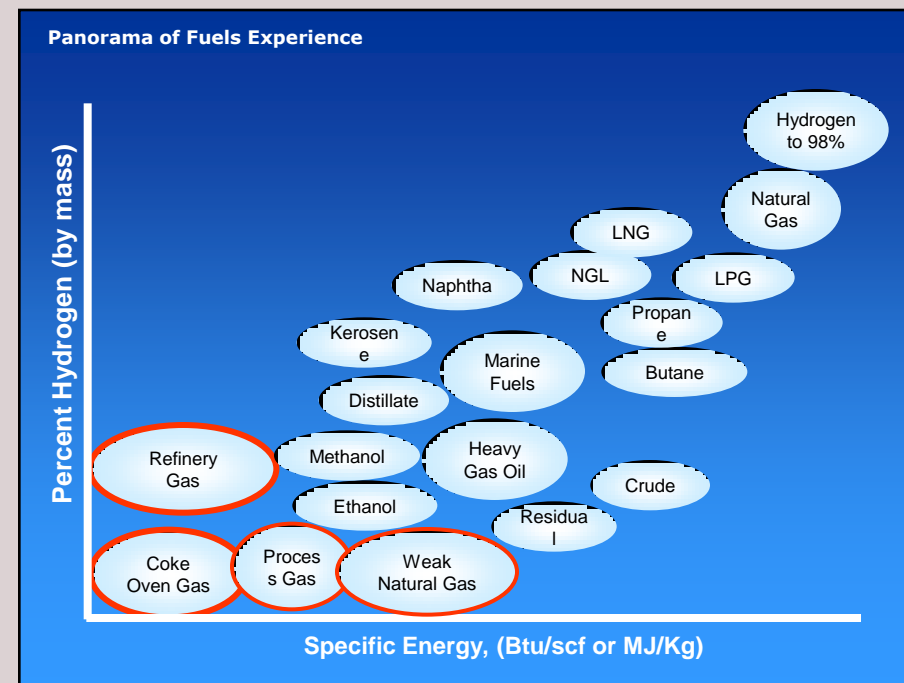
DLN1 generation



DLN2 generation

Gas turbines burn a wide array of fuels

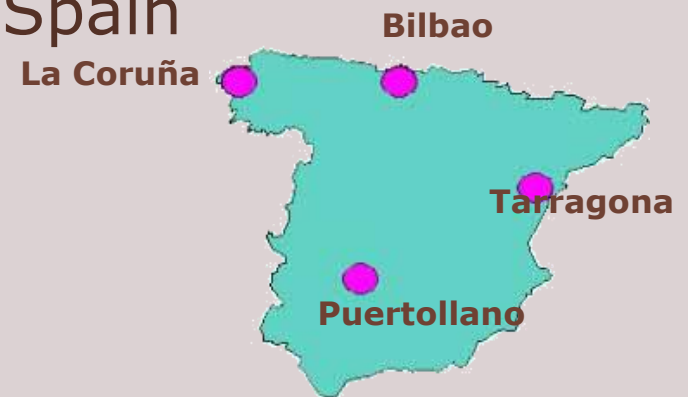
- E-class HDGT (frame 6B–9E–7E) are among the most fuel flexible prime movers
- A wide portfolio of alternative fuels are burned in refineries and petrochemical plants:
 - Fuel gas
 - Process gas tails
 - Distillate & non-distillate fuels



Example 1: Repsol

A rich GT fleet utilizing fuel gas

- Repsol has installed around 15 Cogen units based on 40 MW class GTs all around Spain
- These machines
 - boast over 80% H&P efficiency
 - utilize a large cluster of fatal fuels
 - that would be flared otherwise
- About 1 millions hours of cumulated operational experience



Puertollano, Spain



Example 2: QatarGas LNG tail gas

- Qatar Gas is installing large capacities of LNG
- (Liquified Natural Gas) production to feed mainly the US, EU and Japanese markets
- Such plants generate "tail gas" that is rich in ethane, propane... and cannot be sold as an LNG fraction
- A fleet 125 MW-class gas turbines *with Dry Low NOx* combustion are being installed to:
 - burn the LNG tail gas
 - drive the compressors of the LNG
 - process



A double value to the operators

Dry Low NOx combustors

Example 3: Tong Hua, China

Avoid flaring Millions of m³ of Blast Furnace Gas

- The vivid development of the iron & steel industry in emerging countries creates a vital need to utilize BFG tail gases produced when reducing the iron ores
- Million of m³ are being flared worldwide due to the low calorific value of these gases.
- Gas turbines can handle those fuels namely within the Corex process.
- Tong Hua is a pilot plant
- commissioned in 2002 in China
- Other major projects in the pipe...



Special BFG burner

Conclusion

- Heavy Duty Gas Turbines are very fuel flexible and can therefore handle a wide variety of fatal gas fuels originating from most various sectors:
 - refining, petro-chemistry
 - LNG plants; Iron& Steel industry...
- Gas Turbines allow to combine :
 - Environmental consciousness
 - Energy efficiency (cogeneration units)
 - Operation reliability and flexibility
- ... that are common values to industrial operators

