



**LPG**  
EXCEPTIONAL ENERGY



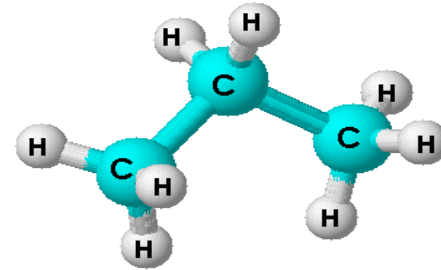
**ASIA LPG  
SUMMIT**  
6 - 8 FEBRUARY, 2017  
NEW DELHI

*LPG: Transforming Lives*

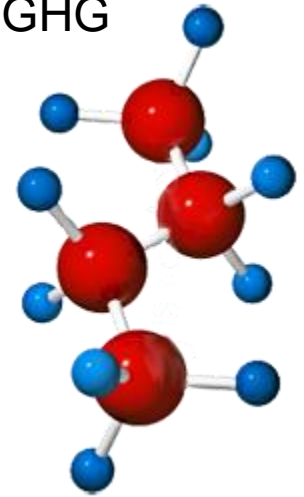
# LPG : BEYOND RESIDENTIAL USAGE

08/02/17 , New Delhi

# WHAT MAKES LPG MORE EXCEPTIONAL IN INDIA

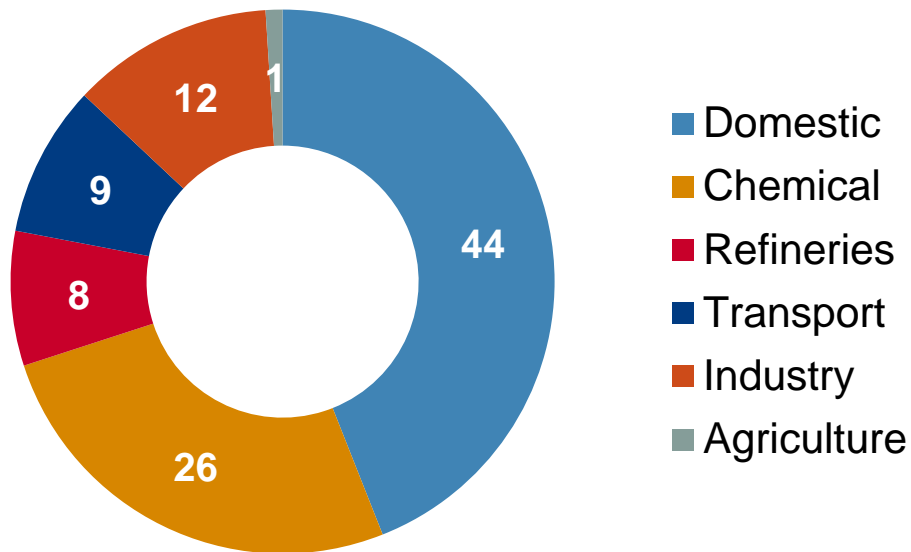


- Carbon-Hydrogen Ratio
  - Though Natural Gas has a better ratio , unburnt Natural gas is a GHG
- High Level of Purity ( field gas ) – fractionation temperature
- Wide spread distribution infrastructure
- Emerging cost competitive infrastructure
- Impending inclusion under GST

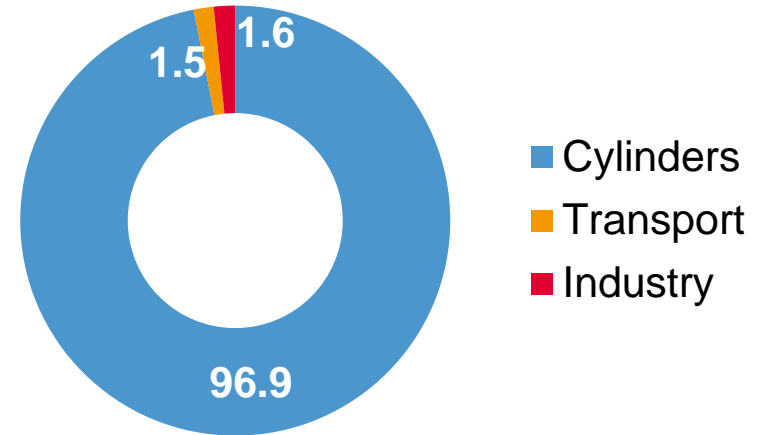


# LPG CONSUMPTION – BY SEGMENTS

## Global LPG Donut % age



## Indian LPG Donut % age



Source – WLPGA Stats 2016 & PPAC

# LPG FUMIGATION



# LPG OPPORTUNITIES BEYOND – DUAL FUEL

- Immediate answer to some of today's pollution problems !
- Can dramatically reduce Nox (>60%) & Particulate emissions (50%)
- Has been known since the invention of the diesel engine !
- Works on both
- Improves power & reduces emissions
- Works by
- Major fumigation & for fumigation < 50% (Automotive)
- Diesel price decontrol and GST mean its time has arrived
- Requires Industry wide collaboration for wider acceptance

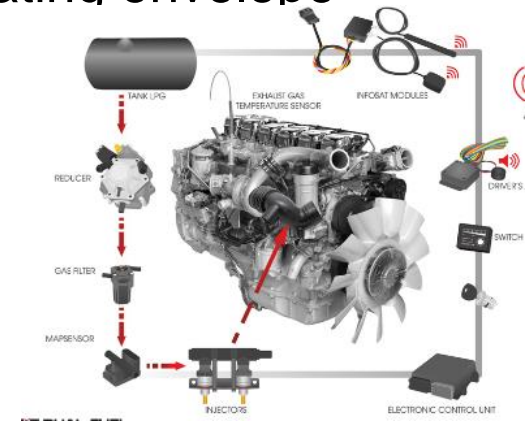
**Liter to Liter  
displacement**

# DUAL FUEL – HOW ?

- No major alteration required – almost non invasive
- LPG is fumigated through the air intake – Venturi or Pulse
- Rate of LPG intake controlled based on load conditions – feedback
- Extent of Diesel displacement based on operating envelope

- System health parameters monitored :

- Water temperature
- Exhaust temperature
- Engine RPM



- Can switch back to Zero fumigation if LPG not available

# DUAL FUEL – OUR EXPERIENCE

- Implemented on a naturally aspirated 160 KVA DG
- Achieved 20% substitution and 3% Volumetric savings
- Dramatic reduction in emission levels
- Trials taken with 2 state transport undertaking buses
- These buses were plying on Hilly routes
- Significant reduction in running emissions ( Dieselgate scandal !)
- 5 to 10% increase in Volumetric consumption – feedback control absent in var RPM
- Excellent feedback from driver – extra boost while negotiating inclines
- Diesel and LPG prices were comparable and hence volume increase killed it !

## IN CASE THERE ARE ANY LINGERING DOUBTS ...



*Railway minister Suresh Prabhu flags off the train that runs on dual fuel system on the Rewari-Rohtak section.*

NEW DELHI: In significant step towards adopting green fuel, the railways have launched their first CNG train. Railway minister Suresh Prabhu flagged off the train, run on dual fuel system — diesel and CNG — on the Rewari-Rohtak section of northern zone.

An official said introduction of CNG trains will reduce greenhouse gas emission and also cut the transporter's fuel bill

by reducing consumption of diesel.

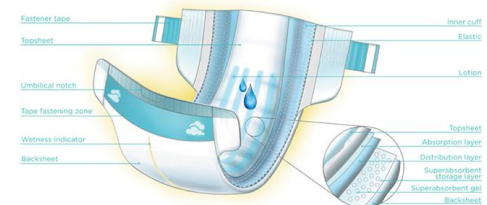
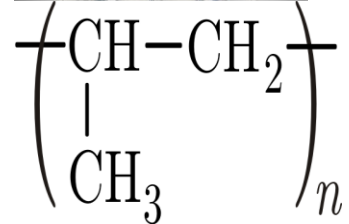


# LPG IN PETROCHEMICALS



# LPG OPPORTUNITIES BEYOND - PETROCHEMICALS

- Building Block Monomers – Ethylene , Propylene
- Structural Shortages leading to on purpose production
- Propane feedstock - Propane Dehydrogenation (PDH)
- World Scale plant – 0.75 to 1 MMTPA ( $\eta = 0.85\%$ )
- Downstream industry development – lack of access to monomers
- High Capex – integrated complex

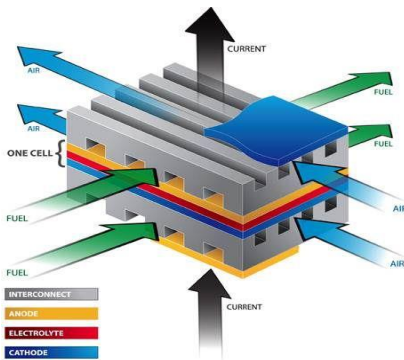


\*Represents currently marketed Pampers® diapers sold in mass market retail outlets only.

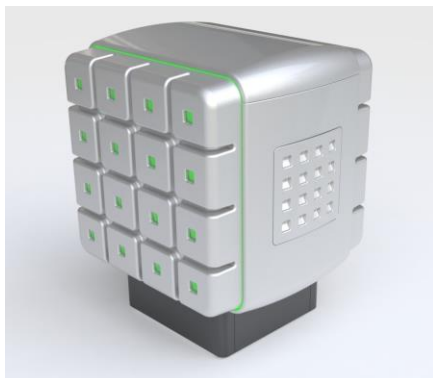
# LPG OPPORTUNITIES BEYOND - PETROCHEMICALS

- A new trend is now emerging – Butane Dehydrogenation
- Demand driven by Packaging & Automotive Segments
- Butadiene , Iso Butylene and n-Butenes
- India Structurally short of Maleic Anhydride
- n-Butane a key reactant
- Butane Splitters

# SOME INTERESTING OPPORTUNITIES



# PROPANE OPPORTUNITIES – FUEL CELLS , SNG , ...



- Packaged Propane is ideally suited
- High level of efficiency > 60%
- Less polluting
- Can be easily deployed



- Substitute in a natural gas economy
- Propane is suited due to its low dew point
- Higher ambient pressure ( Venturi effect SNG)



- Used for Polystyrene sheet extrusion
- Propane / Butane is suited as foaming agent
- Fast growing small scale industry
- Usually close to major markets

# LPG OPPORTUNITIES BEYOND – GLOBAL TRENDS

## Aviation Fuel



# LPG OPPORTUNITIES BEYOND

For a comprehensive reference

[www.lpg-apps.org](http://www.lpg-apps.org)







TOTAL COMMITMENT  
**SAFETY**  
FOR ME, FOR YOU  
FOR ALL



# Thank you