

Gas Membrane Separation Technology

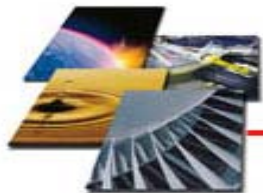
Indagro

Projects - Machinery- Engineering- Automation - Gas -Water- Power & Fluids Technology

Indagro Engineered Systems

NGL Separation -Applications

- Dew point control
- Conditioning of rich fuel gas for turbine specs
- Gas “Up-grade” or “enrichment”
- Several reference plants
- Good fix for “black start gas” problem



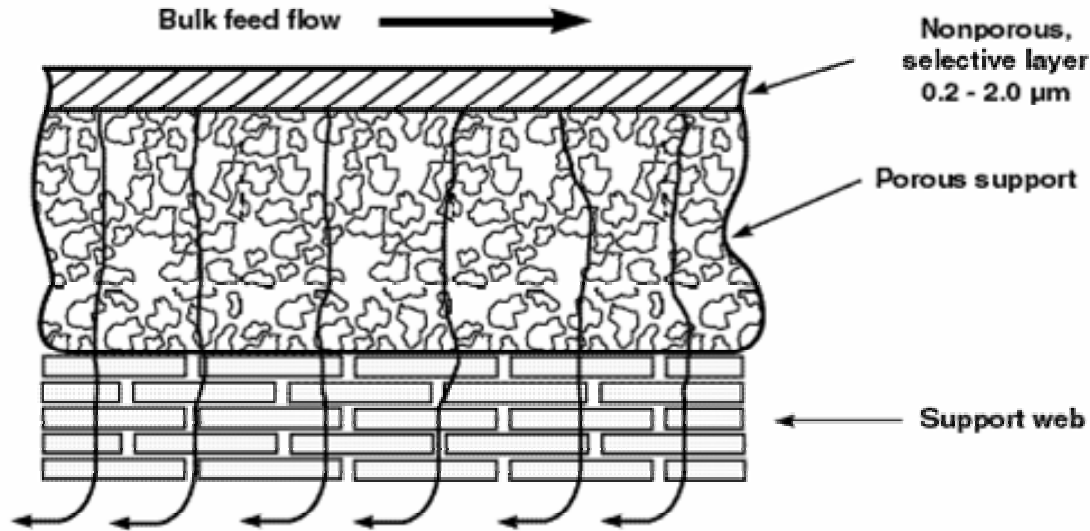
GE Osmonics



History of NGL Membrane Applications

- A long history of use for various hydrocarbon separation and recovery applications
- Commercial success – Prestigious Kirkpatrick Award
Winning Technology
 - ♦ Applied for wide range of flows: 0.2 to 90 MMscfd
 - ♦ Applied at wide range of pressures: 50 to 1,000 psia
- More than 80 reference plants worldwide
- Customers include ExxonMobil (8 Plants), BP Amoco (4 Plants), Sabic (4 plants), Formosa (10 plants)
- More than 400 years of cumulative on-stream time

Composite Membranes: A Breakthrough in Membrane Technology

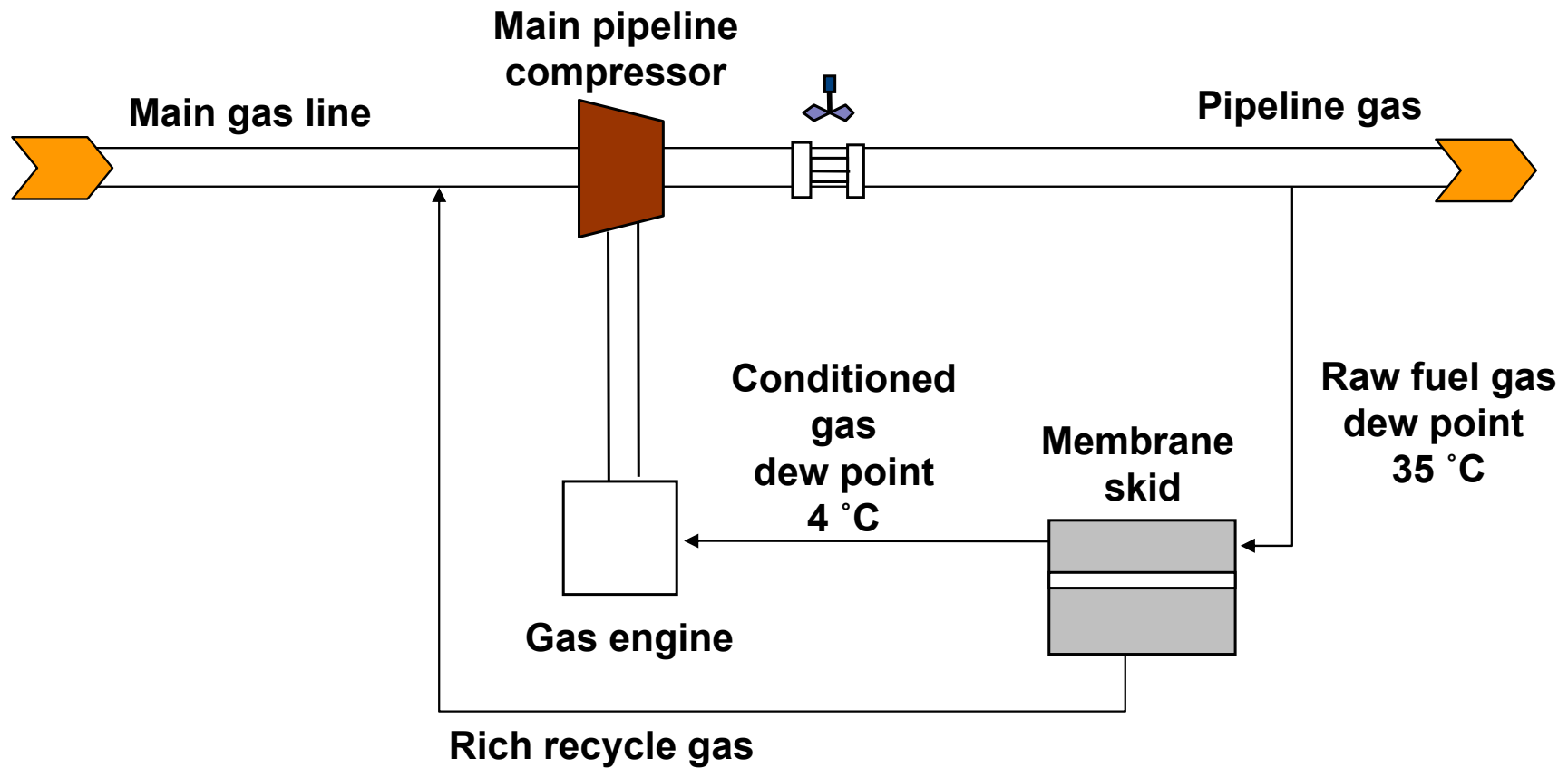


- Reduced pretreatment
- Greater flexibility in material selection
- Better performance
- Many new applications

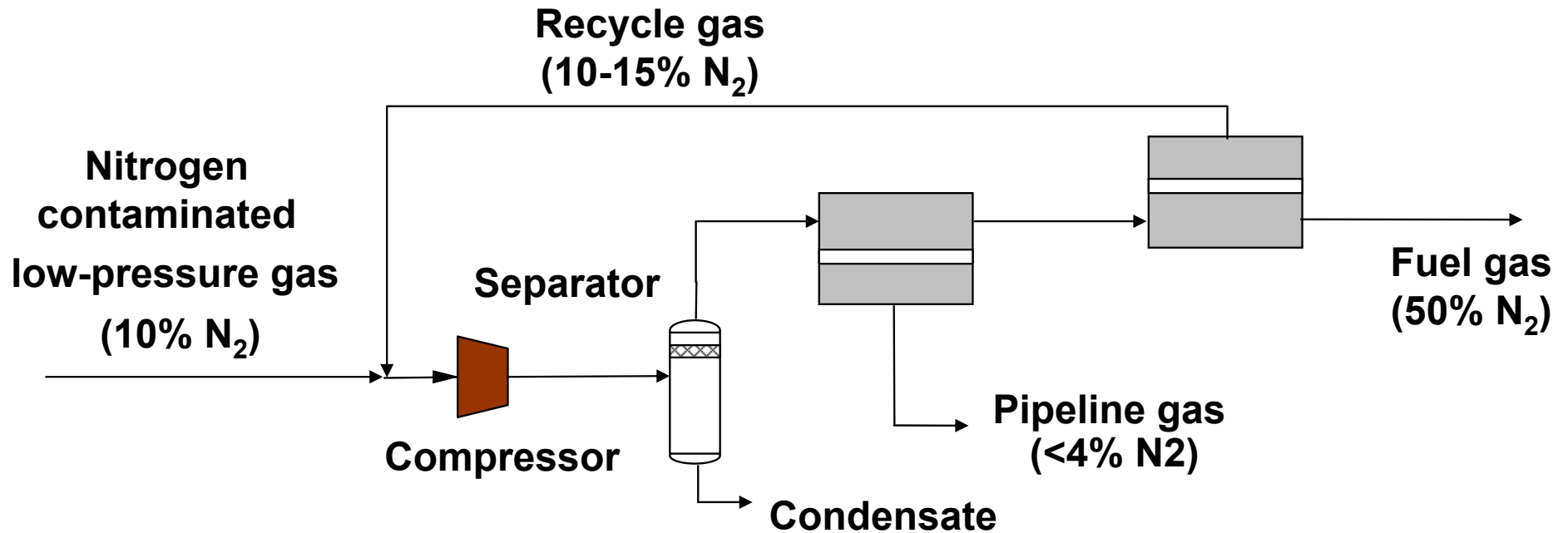
NGL Separation - Applications

- Dew point control
- Conditioning of rich fuel gas for turbine specs
- Several reference plants
- Good fix for “black start gas” problem

Fuel Gas Conditioning Process Design



Nitrogen Removal Process

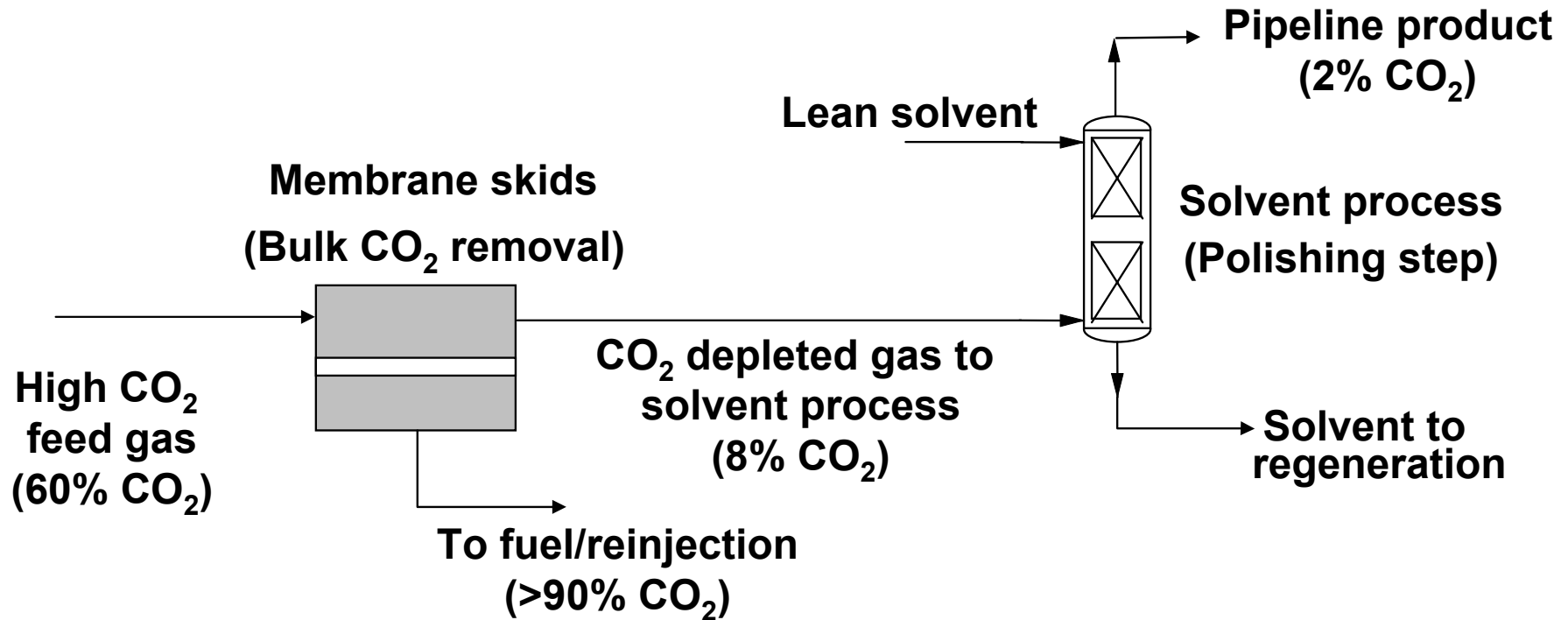


Nitrogen Removal Skid

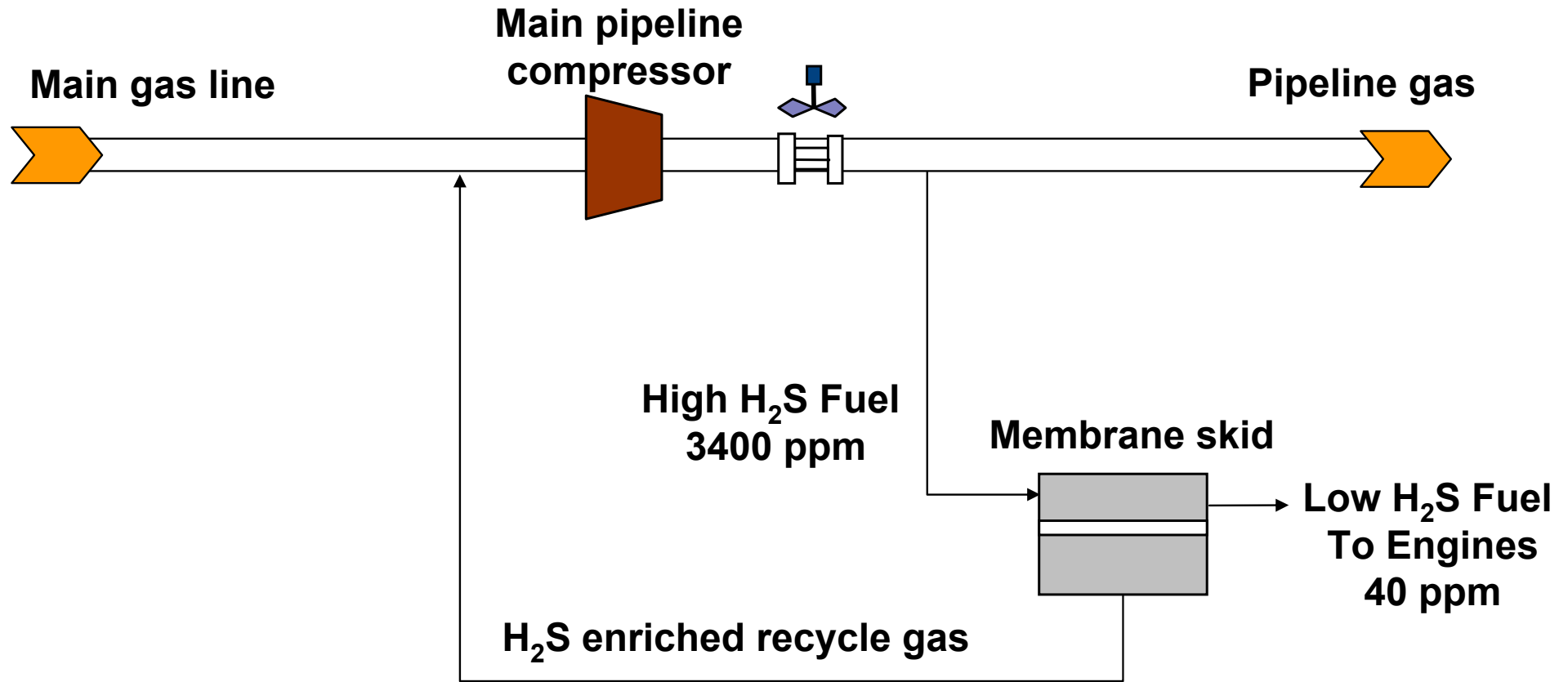


- Operational since November , 2002
- Constant performance reducing N₂ content in natural gas from 6.5 mol-% to 2.5 mol-%.
- System Turndown to 50% on the fly

CO₂ Removal: High CO₂ Feed Gas



H₂S Removal – Fuel Gas Treatment



NGL Separation – UEG (El Paso) System



- Operational since May, 2002
- Processing 90 MMSCFD @ 900 psig
- Constant performance reducing C_{3+} to meet Siemens Turbine Fuel Specs.
- System Turndown to 25%
- System delivery in 14 weeks.

Nitrogen Removal Process – Green Ranch



- Under Installation at Site
- Reducing N₂ content in natural gas from 24 mol-% to 4 mol-%.
- Unattended operation – Remote Monitoring
- Capacity: 1 MMSCFD
- Designed for maximum flexibility for variation in inlet pressure, product pressure and flow rate.