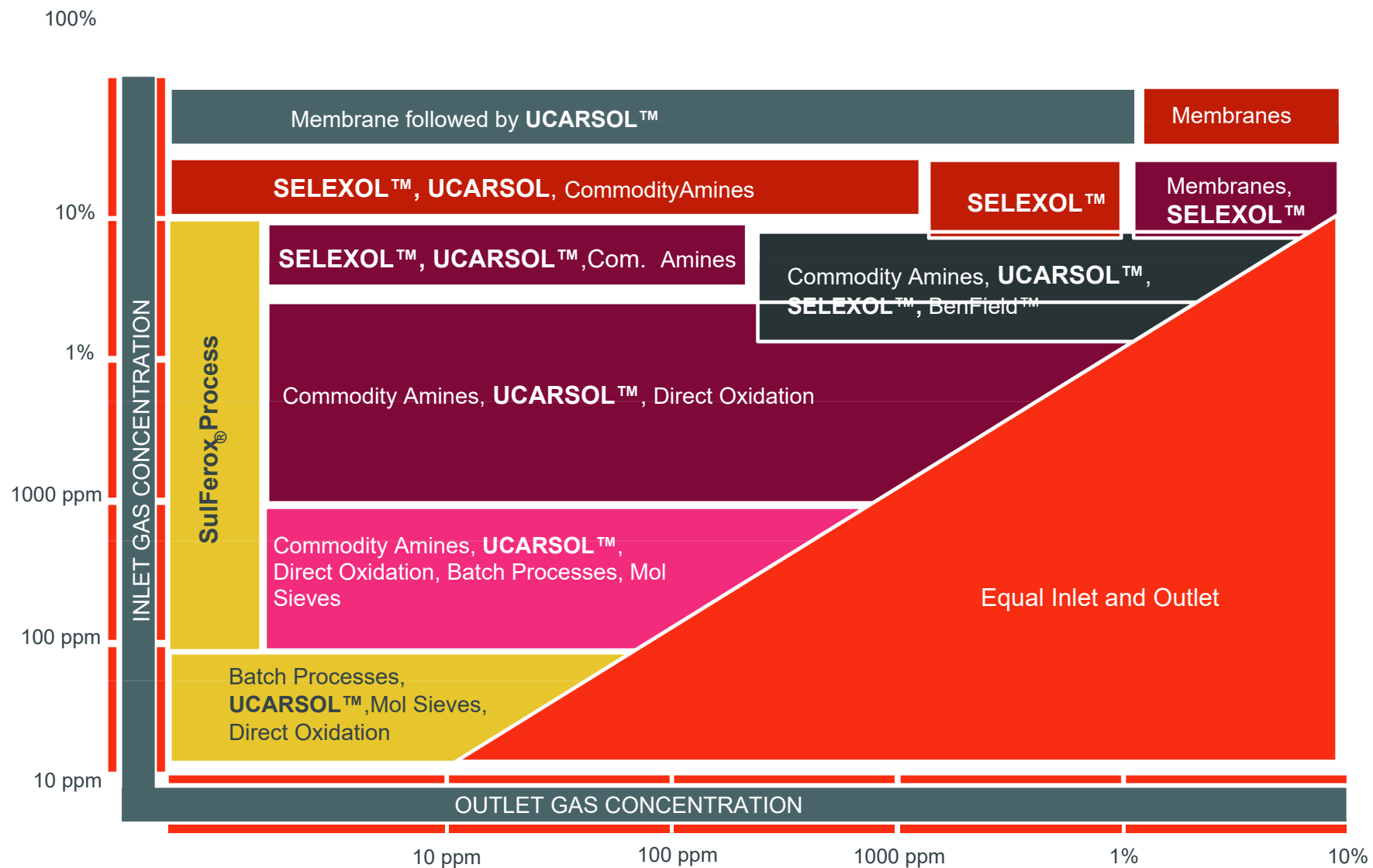


■ UCARSOL™ AP Solvents

- UCARSOL™ AP-800 Solvents are the latest generation of Dow solvents to remove carbon dioxide
- MDEA based solvents with different levels of activator, depending on the required sweet gas specification
- CO₂removal applications include Natural Gas, LNG, Ammonia, IGCC, and Cryogenic Processing units.
- The AP-800 Solvents are advanced performance CO₂removal products, outperforming other competitive solvents in the market place
- Technology can be offered on a non-licensed basis.
- For licensed approach, UOP can offer an Amine Guard™ FS license
- 15-Year Track Record
- More than 250 References



Acid Gas Removal Technologies



■ Key Offerings for Amine Sweetening

UCARSOL™ Solvents

Multiple formulations used for gas treating; each provides key benefits, depending on customer specifications

Selective H₂S – preferentially absorbing H₂S while allowing CO₂ to slip

- UCARSOL™ HS-101 for gas treating
- UCARSOL™ HS-102 for acid gas enrichment
- UCARSOL™ HS-103 for tail gas treating
- UCARSOL™ HS-115 for liquid hydrocarbon treating

Tunable CO₂ removal – removal of CO₂ to a desired specification

- UCARSOL™ AP-802, AP-804, AP-806 – removal of CO₂ to pipeline specification
- UCARSOL™ AP-810, AP-814 – removal of CO₂ to cryogenic
- UCARSOL™ NH-608, for removal of CO₂ in ammonia applications
- CO₂ capture in coal based power plants using UCARSOL™ FGC-3000

Mercaptan and organic sulfur removal capturing organic sulfur compounds requires unique solutions

- UCARSOL™ LE-701, LE-702 – removal of organic sulfur and meeting total sulfur specification

Refinery, low-energy solvents where removal of bulk components is desired, but minimizing energy is key

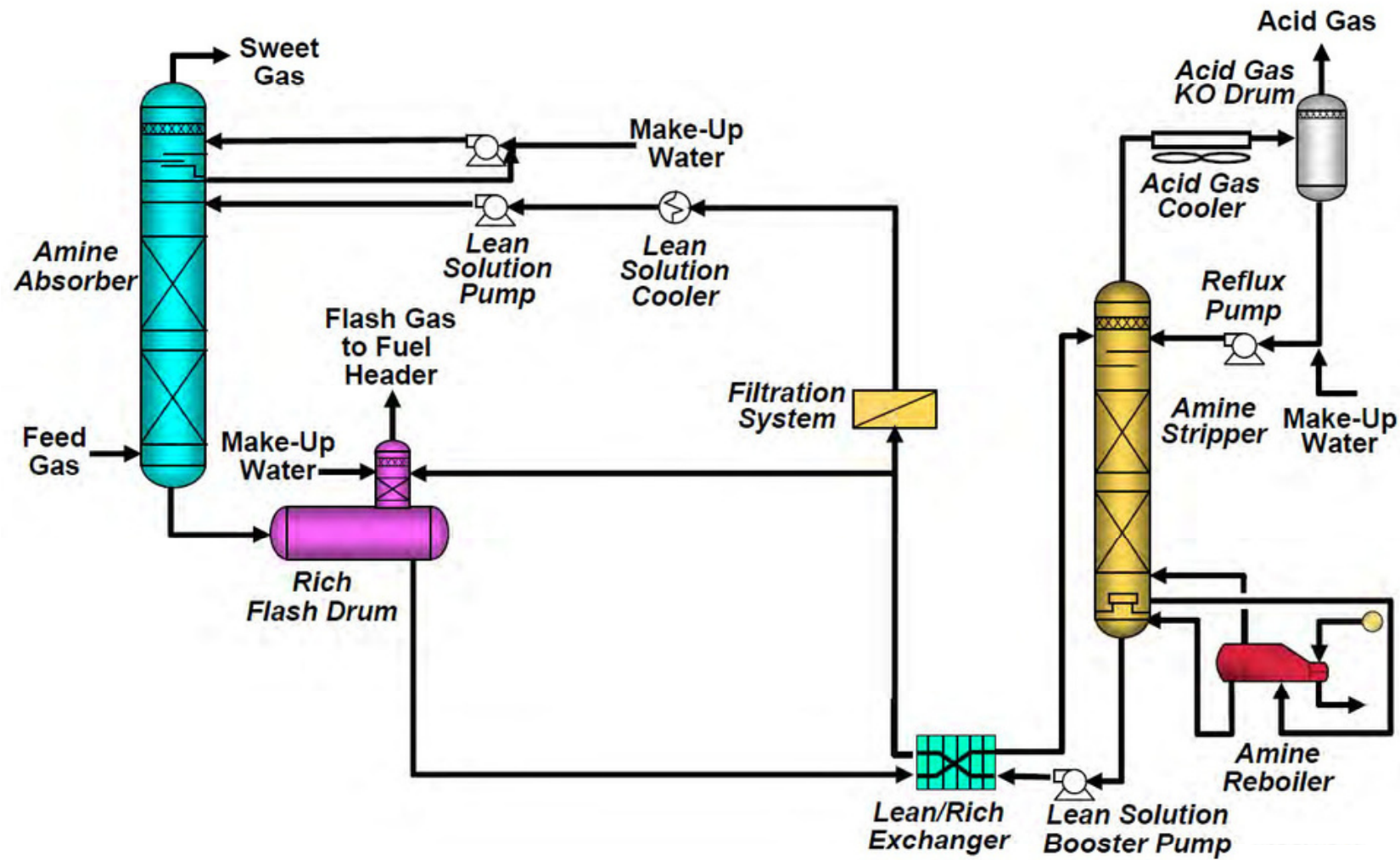
- UCARSOL™ LE-713, LE-777, LE-801 – maximize energy savings

SELEXOL™ Solvent

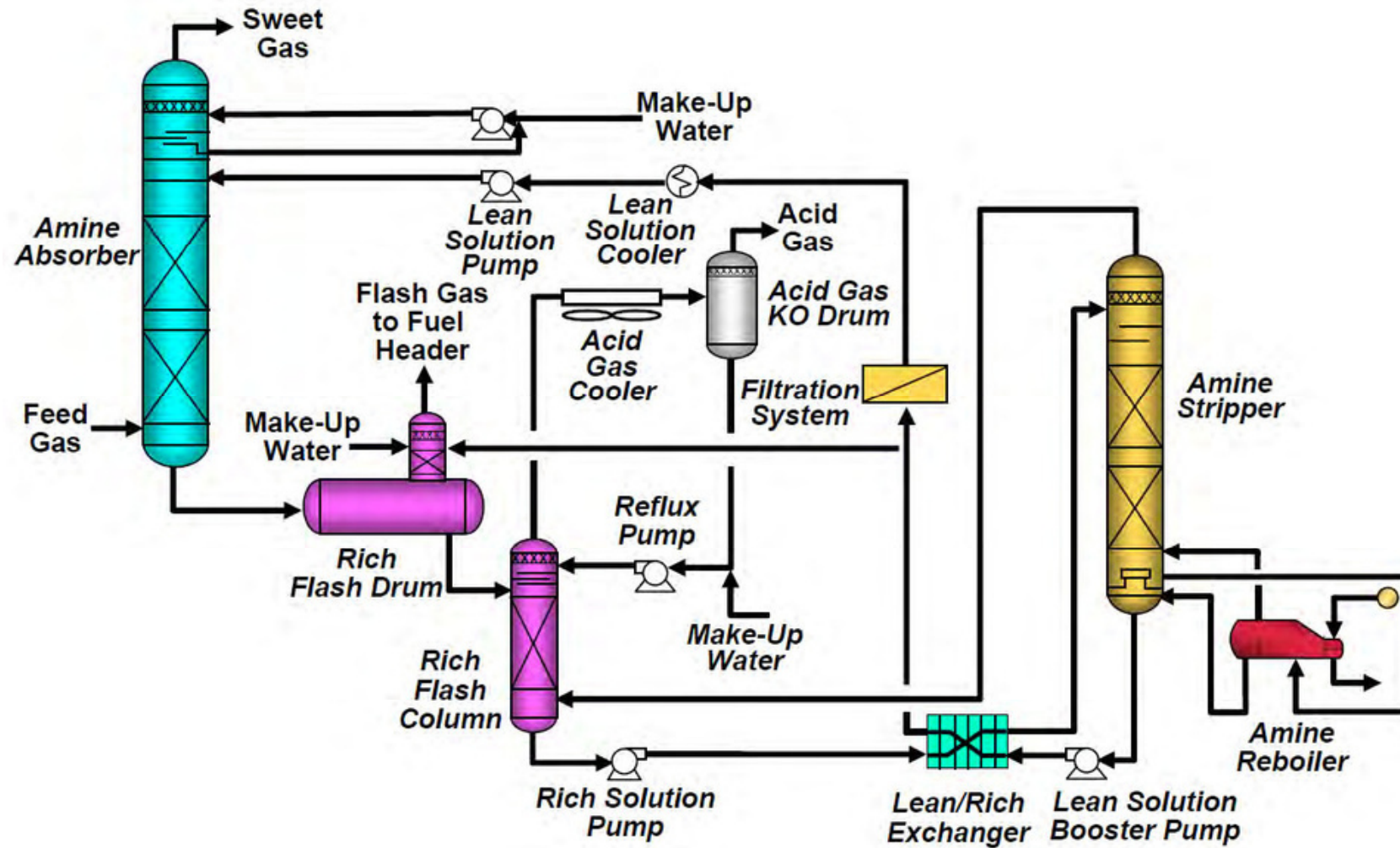
Removal of acid gas, organic sulfur and hydrocarbons when there is a high partial pressure of target components



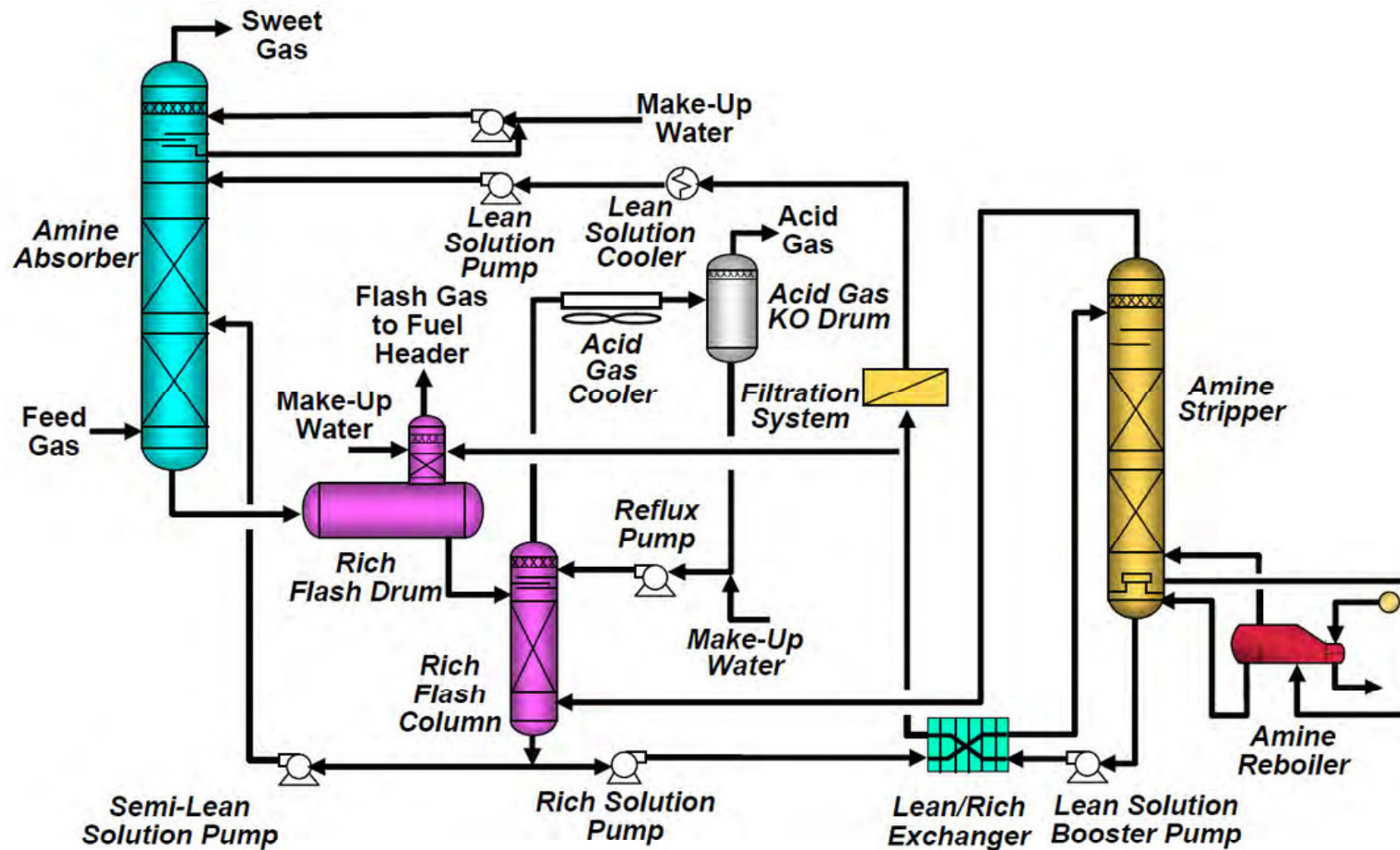
Conventional Process Scheme



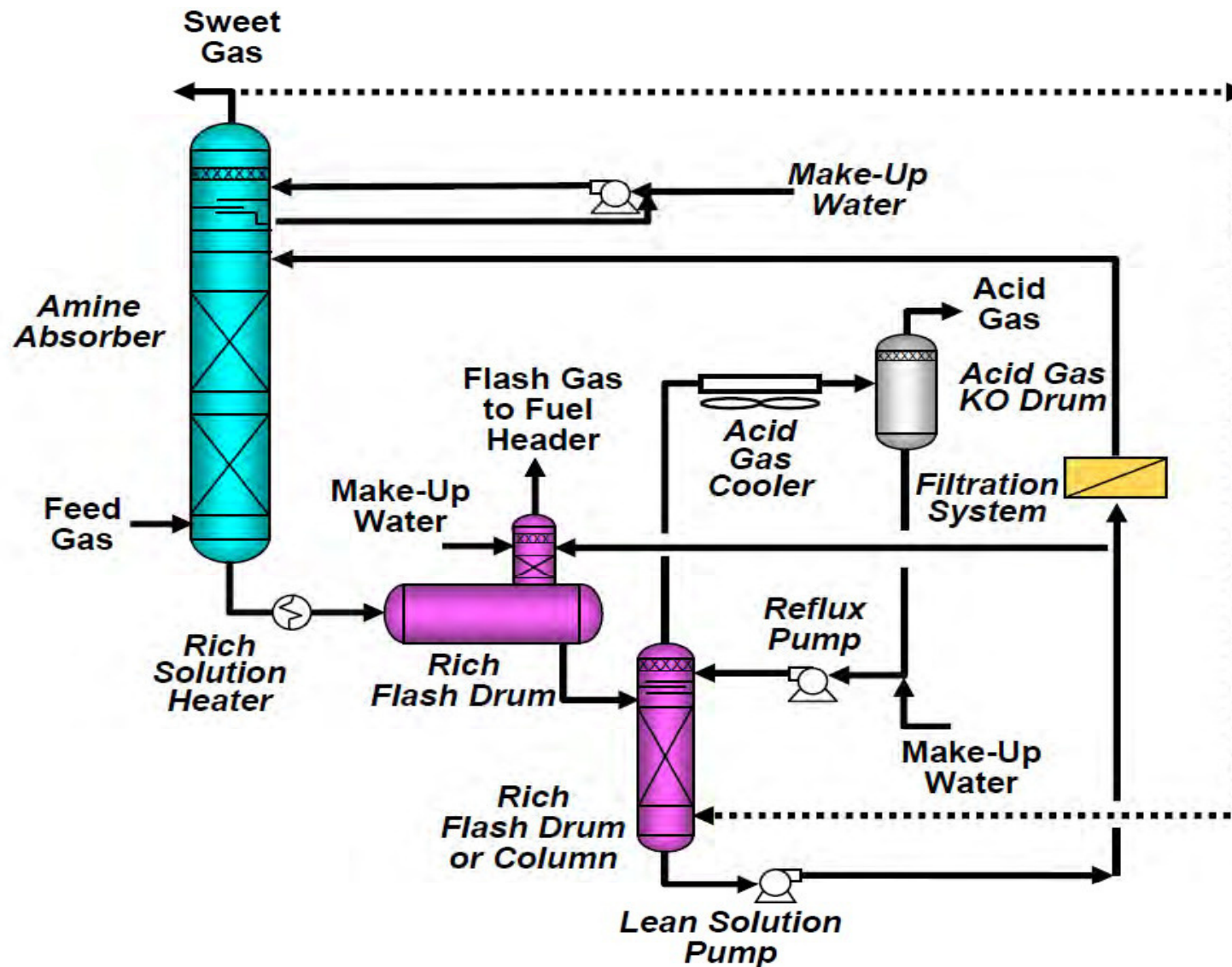
One Stage Process Scheme



TwoStage ProcessScheme



Flash Regeneration Scheme



■ Comparing DEA and UCARSOL™ AP-814 Performance

Capacity Increase

	<u>33% DEA</u>	<u>45 % AP-814</u>
Processing capacity, kNm ³ /hr	152	188
Circulation Rate, m/hr	217	230
Solvent CO ₂ loading, mol/mol		
Lean	0.06	0.03
Rich	0.49	0.46
Reboiler Duty, Gcal/hr	12.6	12.6
Treated Gas CO ₂		
Outlet from absorber	2%v	100 ppmv



■ AmmoniaPlant Ukraine

ComparingMEA withUCARSOL™ NH-608 Performance

	MEA System Performance	UCARSOL NH-608 Performance
Recirculation Flow 1	650-670 m ³ /hr	450-460 m ³ /hr
Recirculation Flow 2	550-570 m ³ /hr	430-450 m ³ /hr
Regenerator Mid Column Temp	115-116 °C	109 °C
Regenerator Overhead Temp	91-93 °C	82 °C
CO2 in Treated Gas	50-80 ppm	18-27 ppm
Reboiler Steam	17+17+3 MT/hr Total = 37 MT/hr	3.5+3.5 + 0.0 MT/hr Total = 7 MT/hr



CO Capture from Coal Based Power Plants

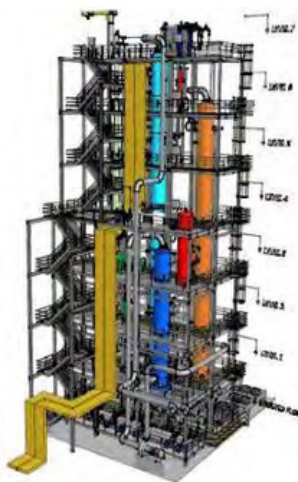
UCARSOL™ FGC Solvent3000

- First Pilot Plant at Dow Chemical Site in Charleston, WV
 - Designed to capture 1,800 t CO₂/year using UCARSOL™ FGC-3000 solvent
 - Installation on commercial coal-fired boiler
 - Project progression
 - Operation began in September 2009
 - Validation of overall performance and unit operation
 - Implementation of 2nd generation improved flow scheme in February 2011
 - Focus on solvent management and emissions measurements, as well as proving concepts of the 3rd generation flow scheme
 - Completed more than 14,000 hrs of operation, 24/7, before pilot was shut down in October 2011

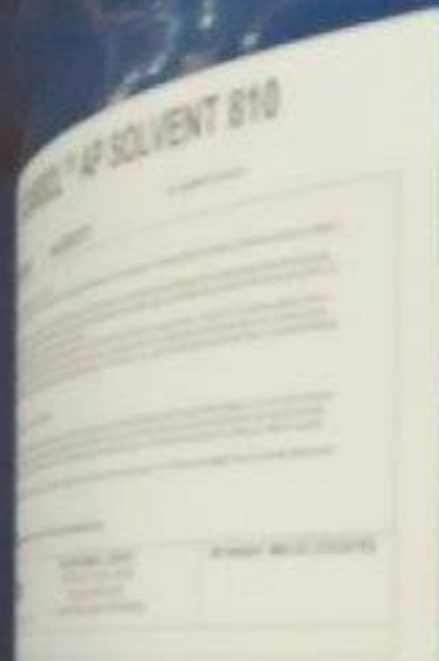


Advanced Amine Field Pilot

Demonstration Unit at EDF Power Plant Le Havre



- Designed to capture 25 t CO₂/day, 90% CO₂ capture
- Advanced flow scheme & operation validation
- Flue gas: slipstream from 600 MW coal plant (EDF host facility)
- French funding by ADEME
(French Environment and Energy Management Agency)
- Project schedule
 - Overall 2010-2013 program
 - Test from Q2 2013 to Q2 2014



2016-07-15