Thirty-Sixth Annual
INTERNATIONAL PITTSBURGH
COAL CONFERENCE
University of Pittsburgh · Swanson School of Engineering

AN OPTIMUM SOLUTION FOR COAL POWER PLANTS TO REDUCE CO_2 EMISSIONS

Plenary Speaker:

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SO_2 and CO_2 Removal from Flue Gases

- Main sources of SO_2 and CO_2 emissions are the fossil fuel-fired boilers; coal, oil & natural gas
- Environmental regulations are the driving force for process selection and its design criteria
  - In 1920, limits on Sulfur Dioxide
  - In 1929, SO_2 removal from large power plant became legal requirement
  - In 1997, CO_2 should be limited, as recommended at the Kyoto Conference, Japan
  - SO_2 removal target is < 10 ppm before the CO2 capture process using amines.
- The removal of SO_2 and CO_2 from flue gases is important in many environmental & industrial applications
- Commercially available technologies but still there is work required to reduce capital and operating expenditures; CAPEX and OPEX

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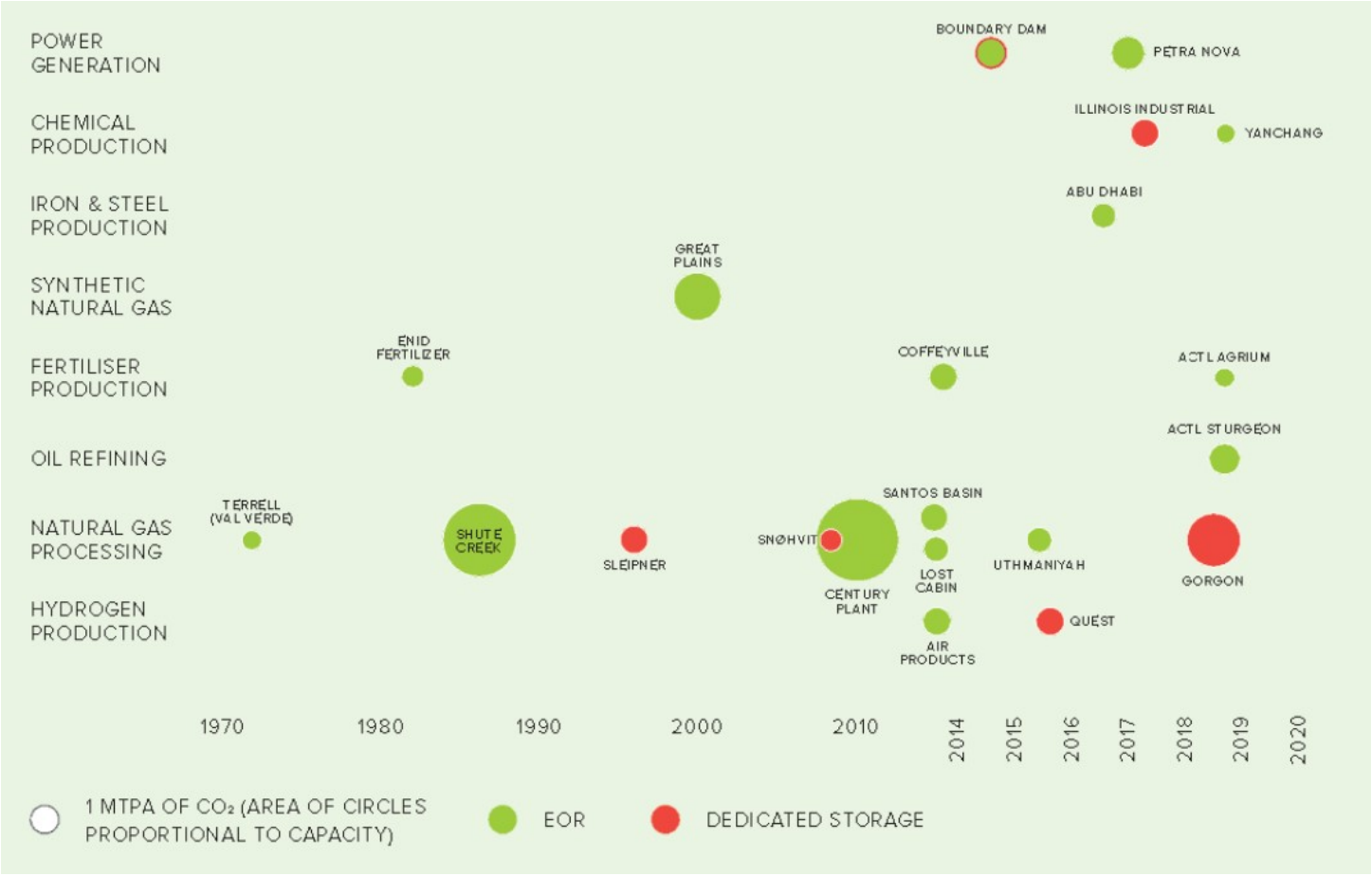
CCSU large-scale facilities in operation and construction by industry (Carbon Capture Journal, Issue 61, Jan/Feb 2018)



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Technology Selection for CO_2 Capture Plants

- CO_2 capture by reactive liquid is a proven & leading industrial technology
- Amines based solvents are available commercially
- Flue gas pre-treatment technologies to protect the solvents are proven and available commercially
- Solvent reclaiming process is required to maintain the solvent efficiency

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AES CO_2 Capture Plant; Cumberland, Maryland, USA In Operation Since 1998, 130 TPD of CO_2

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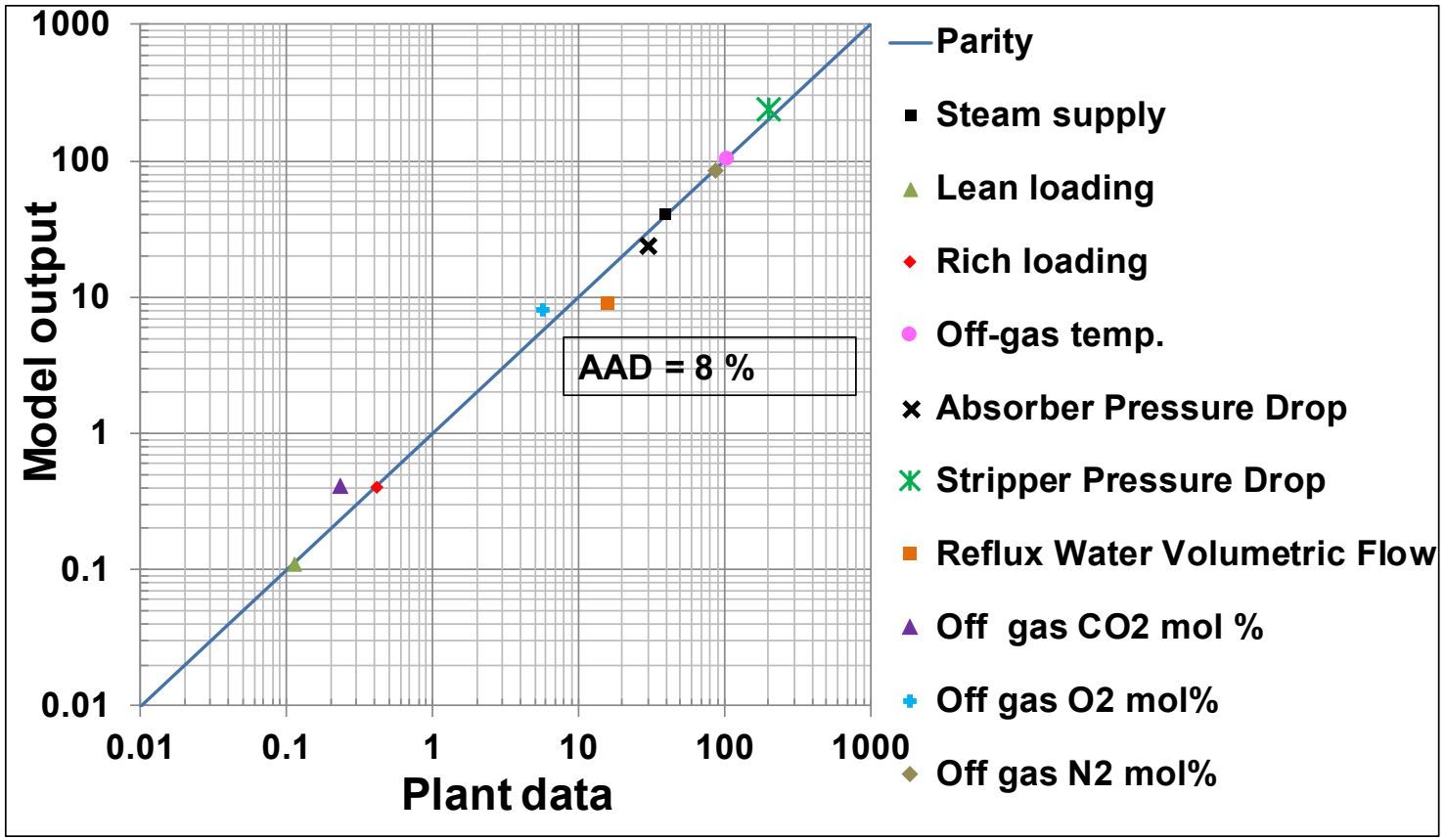
Plant Data Versus Predicted Data, ±8% average absolute deviation



Ahmed Aboudheir and Walid Elmoudir / Energy Procedia 37 (2013) 1509 – 1516

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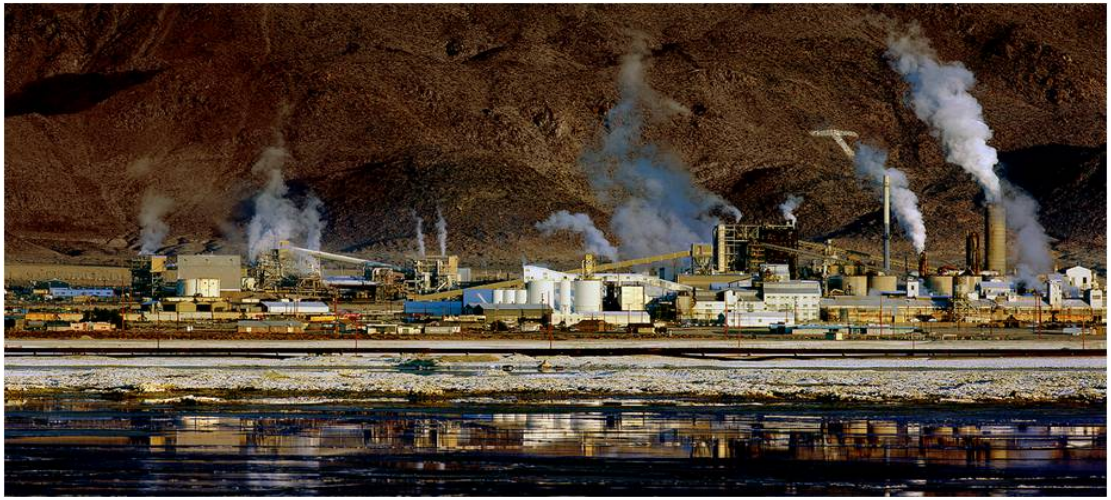
SVM CO_2 Capture Plant; California, USA
800 TPD CO_2, In Operation Since 1977



Searles Valley Minerals

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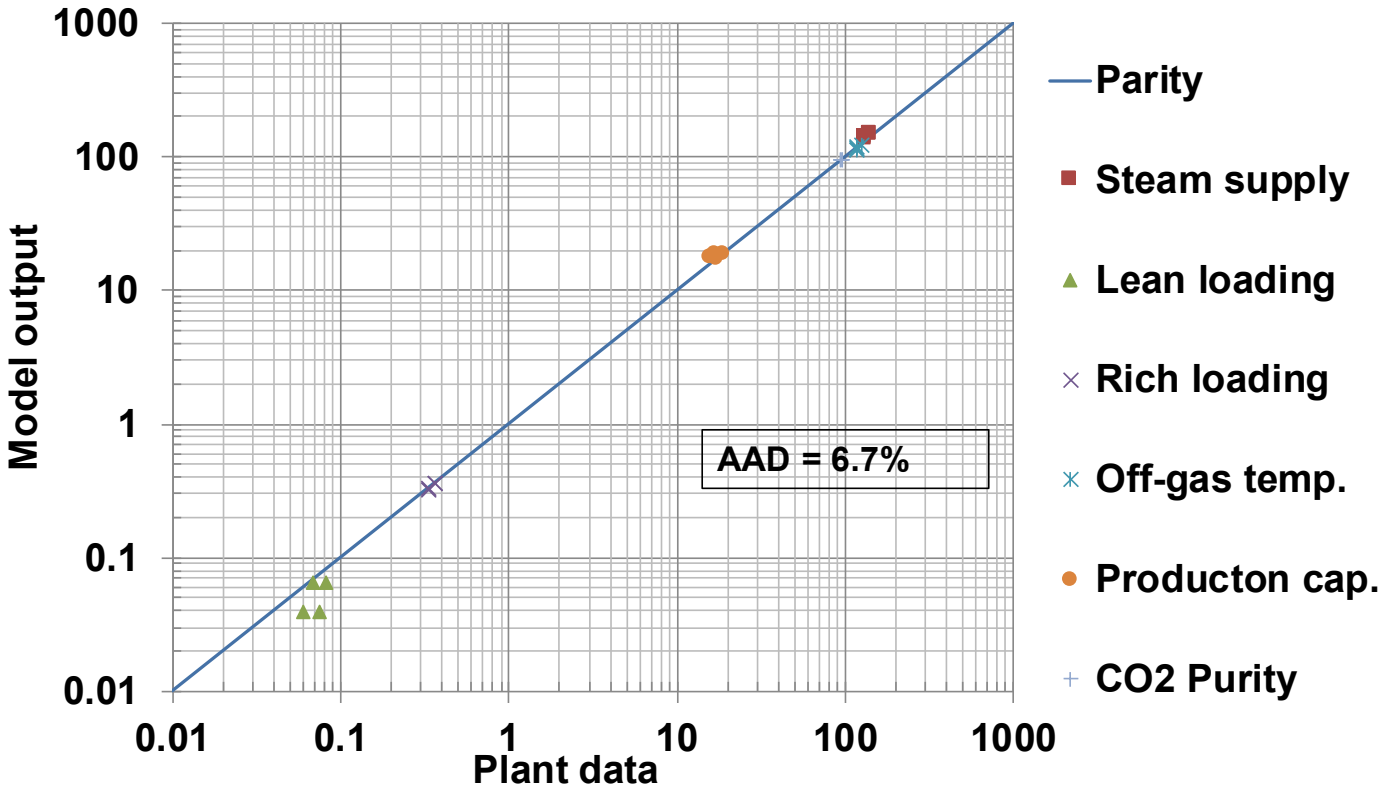
SVM, Measured and Predicted Performance, AAD% ± 6.7



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Boundary Dam CO_2 Capture Plant, 2014 Saskatchewan, Canada, 3000 TPD

www.saskpower.com

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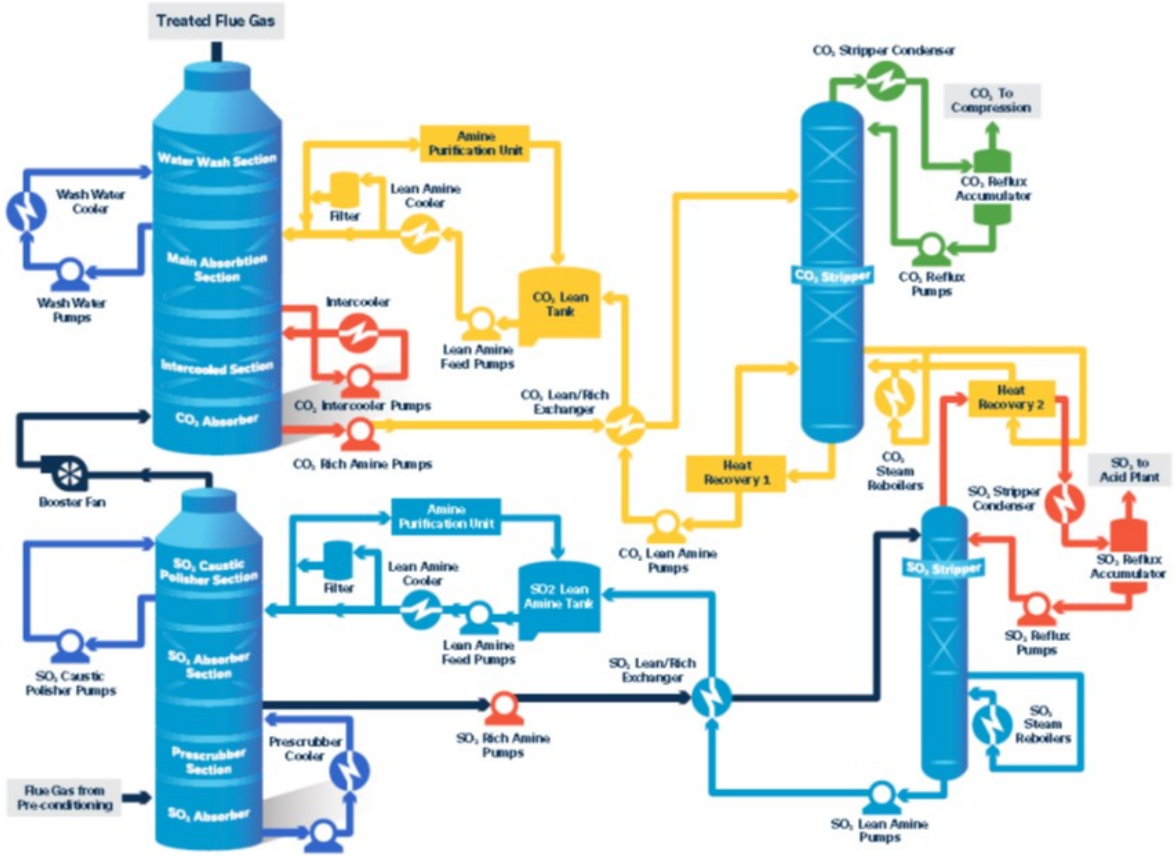
SHELL CANSOLV'S COMBINED SO_2 AND CO_2 CAPTURE PROCESS



ieaghg report Number 2015/06, August 2015

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Parish Petra Nova CO_2 Capture Plant, 2016 Texas, USA, 4,800 TPD of CO_2

- 16-foot-Diameter Flue Gas Duct (5 m)
- 120-foot-tall quench tower (37 m)
- 360-foot-tall Absorber Tower (110 m)
- 160-foot-tall Stripper Tower (49 m)
- 27-foot-diameter Stripper Tower (8 m)

Power, Vol. 161, No. 8, August 2017, P. 20-25

www.nrg.com/generation/projects/petra-nova/

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What are the main design parameters affecting the commercial post combustion CO_2 capture plants?

- Process configuration & plant water balance design
- Energy type & its sources
- Solvent type & its composition
- Solvent reclaiming & reuse

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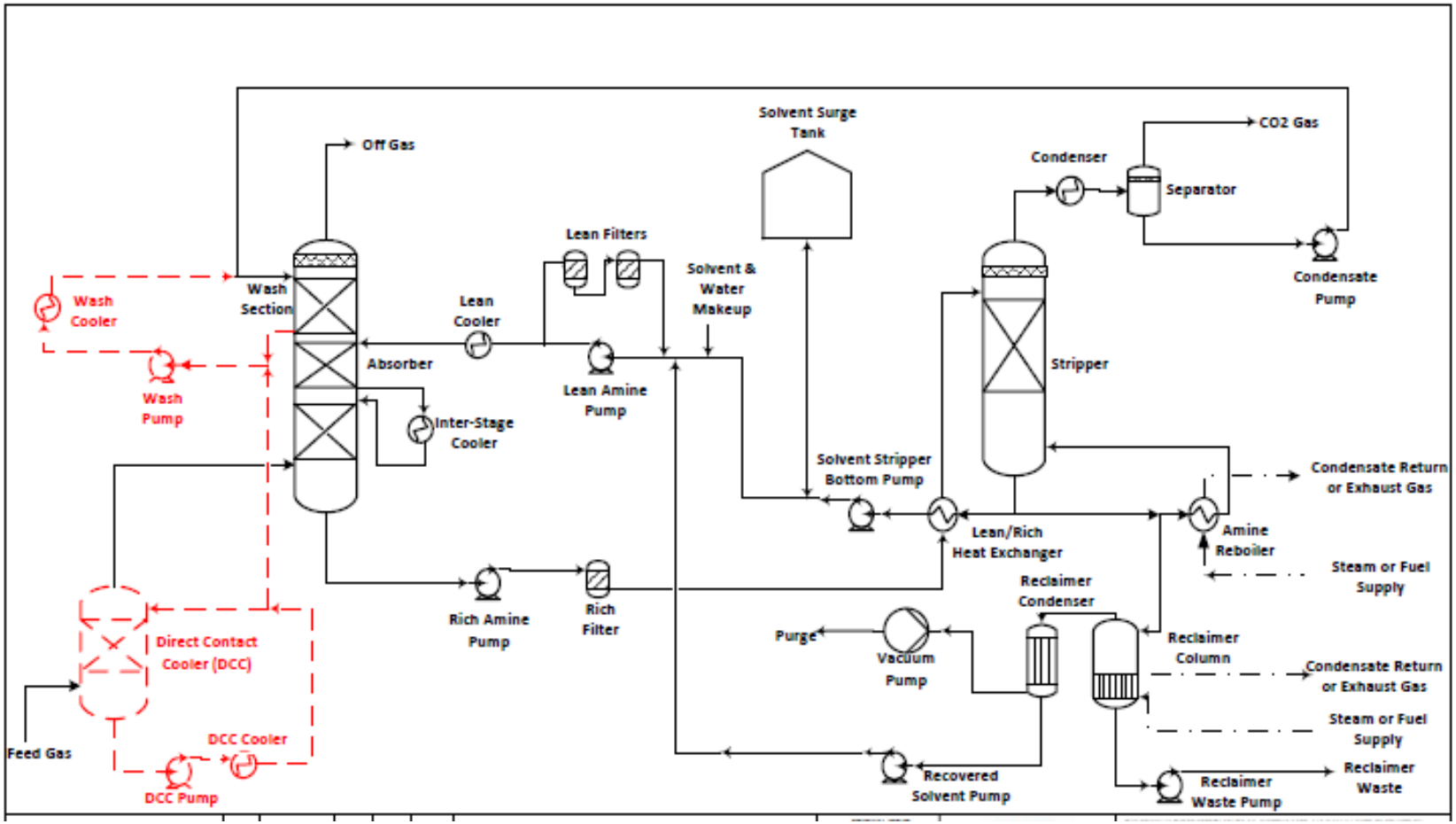
Using **proper process configuration** & **optimum plant design** can significantly reduce CAPEX and OPEX.

➔ **No utilities from the Power Plant is required.**



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Using **Direct Fired Reboiler** to provide the required heat duty for the CO_2 Capture Plant and Solvent Reclaiming Unit.

➔ **No steam from the Power Plant is required.**

Husky Demo CO_2 Capture Plant

Husky Energy

Direct Fired Reboiler

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Using single & highly reactive solvents ➔ can reduce the CAPEX significantly

Item	Petra Nova CO_2 Plant	MEA CO_2 Plant Design	Note
Plant Capacity, ton/day	5,265	5,270	Short tons
CO_2 Purity, %	> 96	>96	Water saturated
CO_2 Recovery Rate, %	90	90	As per DOE
Flue gas rate, lb/hr	2,827,000	2,850,000	Coal flue gas
Solvent type	*KS-1	30 wt% MEA	*Formulated Solvent
Solvent rate, lb/hr	*Not reported	5,950,000	*Confidential
Absorber diameter	*30 ftx40 ft	49	*Rectangular Column
Absorber packing depth	100 ft	< 40 ft	Reaction zone

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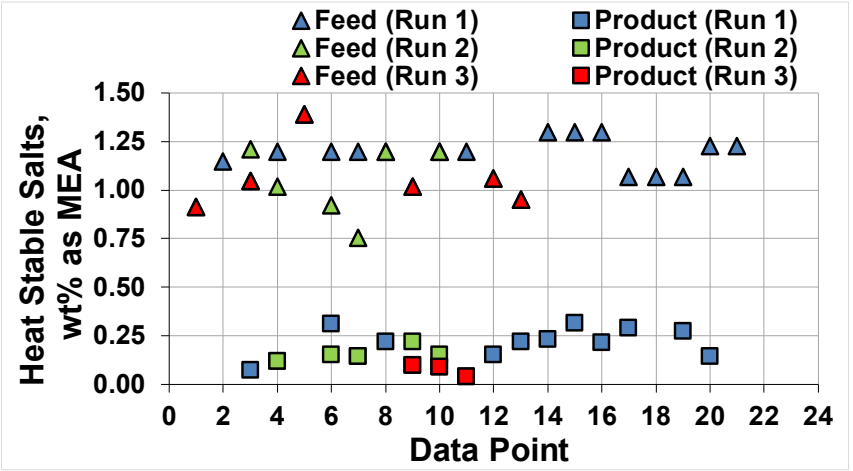
Using **proper design** for the **Solvent Reclaiming System**

➔ will maintain the solvent efficiency, stable CO_2 production capacity, less solvent makeup, minimum emission to atmosphere, and minimum waste for disposal.



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THANK YOU …

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