Capturing Carbon:

The Quest for Meeting Regulations

$_{s}C_{h}O_{2}^{ff}$ bandi berryhill

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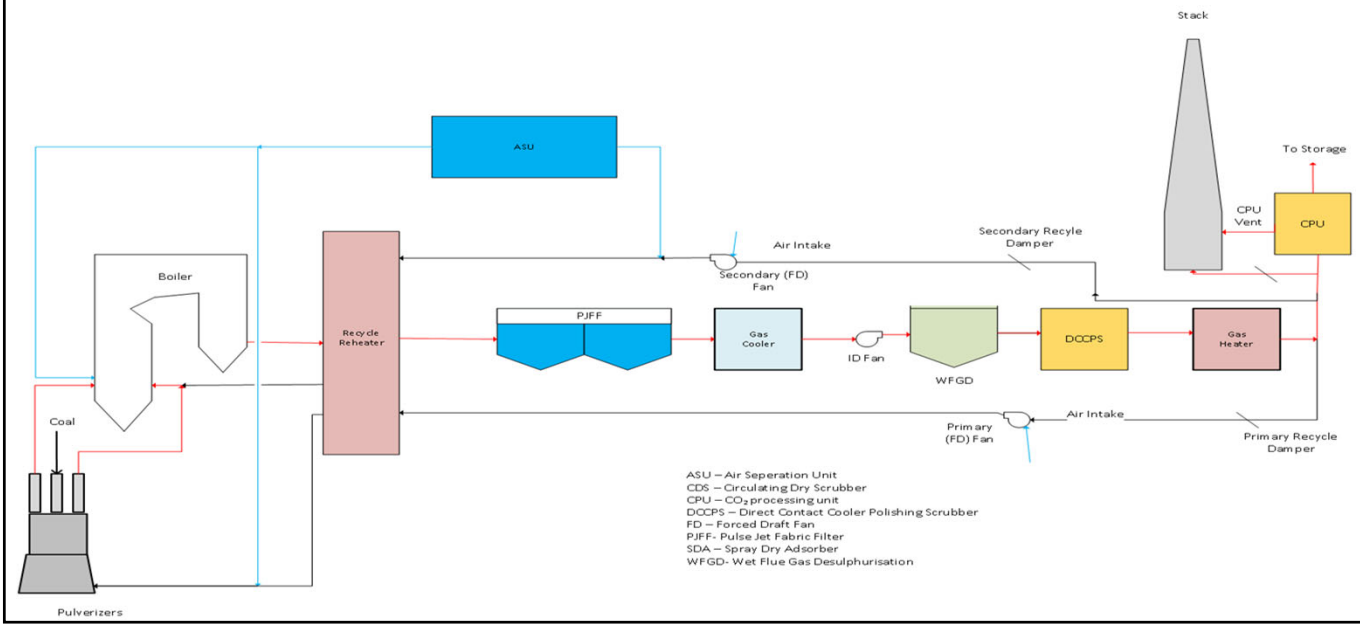
#1 Oxyfuel Combustion



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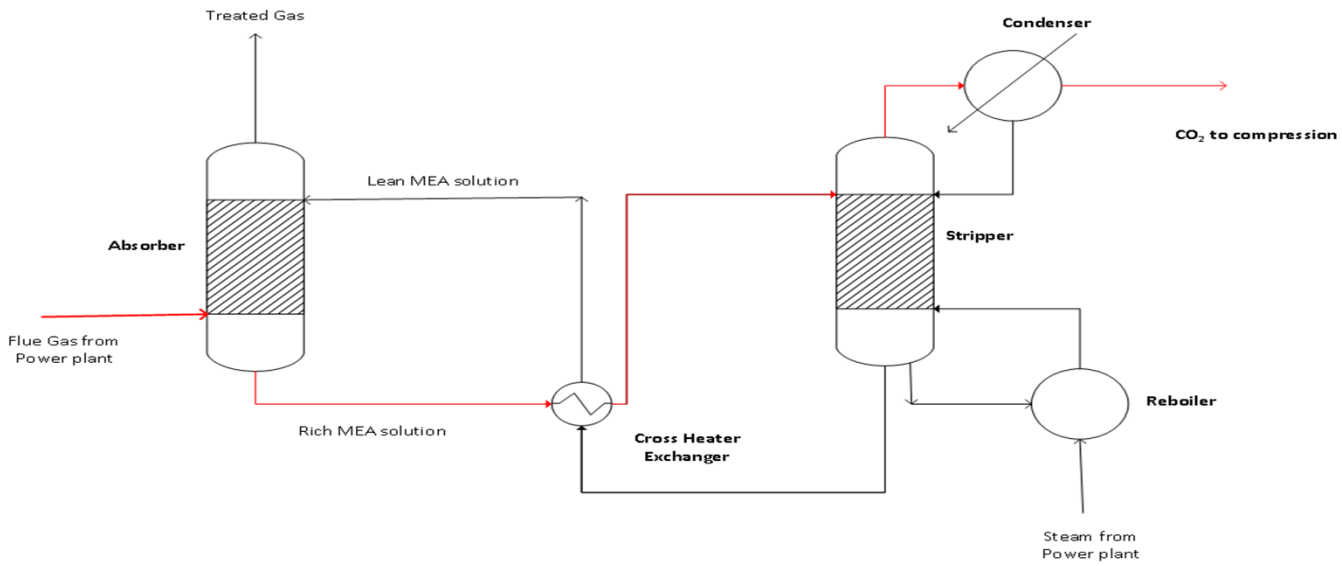
#1 Solvent Absorption



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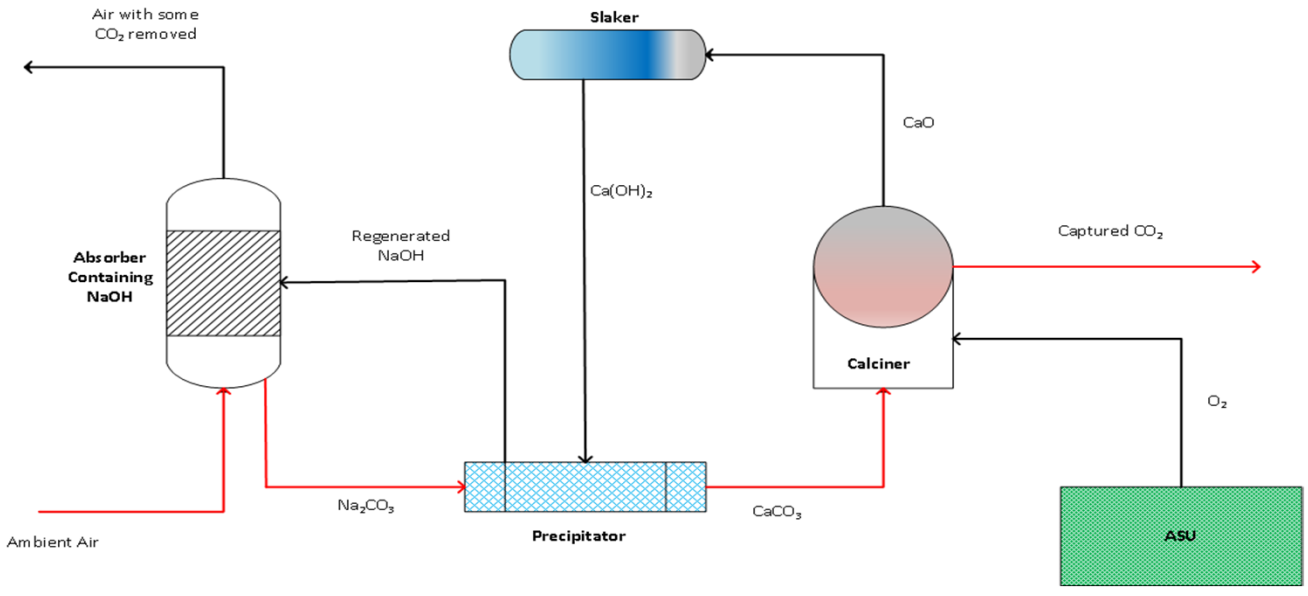
#1 Direct Air Carbon Capture



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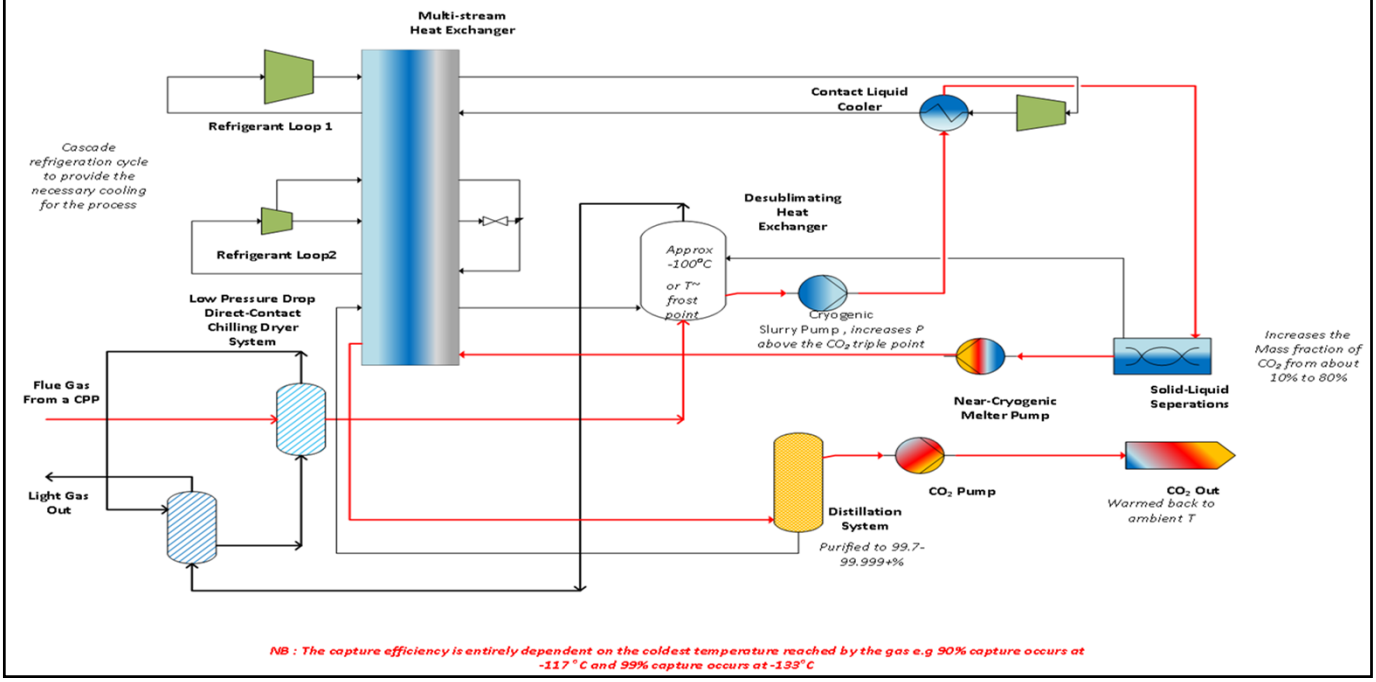
#1 Cryogenic Carbon Capture



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#2 Oxyfuel Combustion

Pros - CO2 can be kept from the combustion products and recycled through as a way to control the flame temperature; easier to separate water and CO2 from each other than if there are other products

Cons - Equipment has to handle high temperatures; CO2 can react with steel and carbonize it. Have to store the captured CO2 in a place it won't leak out into the atmosphere. Requires high pressure pure O2. Depends on economic incentives

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#2 Solvent Absorption

Pros - Widely used; lots of research has been done to find effective solvents that capture CO2 well.

Cons - Not the most viable long term solution for CCS, high capital and operating costs; energy intensive with large equipment

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#2 Direct Air Carbon Capture

Pros - Can be built pretty much anywhere (including offshore), so they can be built near areas with high emissions, such as transport or industrial sectors. Low ecological impact (unless some of the sorbents or bases used are mishandled and make their way into the environment)

Cons - Very energy intensive; energy needs to come from sources that produce minimal CO2, otherwise about 70-90% of the CO2 captured is released from the gas combustion that provided the energy

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#2 Cryogenic Carbon Capture

Pros - Dr. Baxter's tech is relatively easy to add on to the combustion process line, removes pollutants other than CO2, and is cheaper than other carbon capture processes

Cons - High pressures and low temperatures can be difficult to maintain; storage space; relatively new technology so limited to usage in power plants

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#3 - Estimate volume of captured CO2 at Hunter at 2 different pressures and ambient temperature.

```
Energy = 450*3*0.9*1000*31536000*0.000947817  #BTU/year
HHV = 12698 #BTU/lb on a dry basis
FixedC = 0.4776 #on a dry basis
CO2 = Energy/HHV*FixedC/12*44*0.453592 #kg CO2/year

NIST = [0.55311,0.0010155] #m3/kg CO2 from NIST RefProp for the 2 conditions

Volume_ambient = CO2*NIST[0] #m3
Volume_BoundaryDam = CO2*NIST[1] #m3

print('Ambient Pressure:      ',int(Volume_ambient),'m3')
print('Boundary Dam Pressure: ',int(Volume_BoundaryDam),'   m3')
```

P = 340.5 atm

```
Ambient Pressure:       1256564 m3
Boundary Dam Pressure:  2307    m3
```

Vapor; 0.47% lower from what IG gives liquid

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