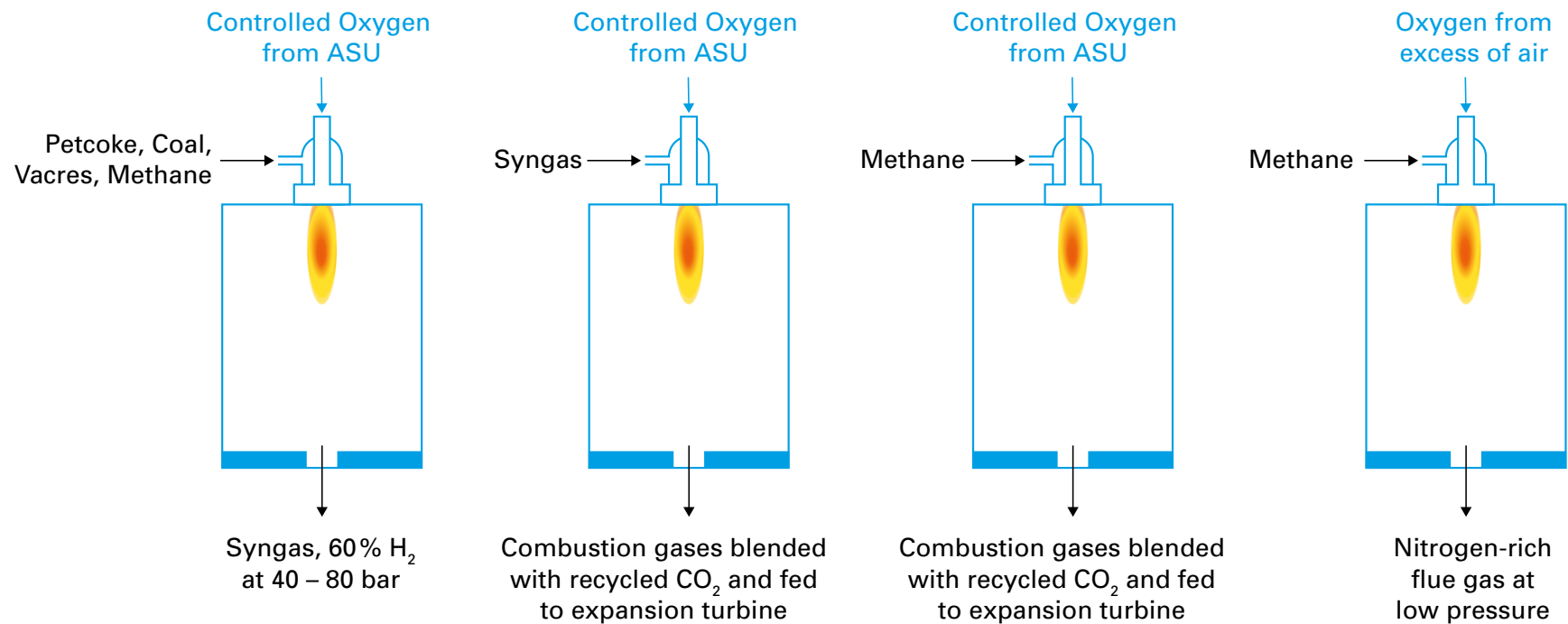


Gasification and oxy-fuel combustion in the Allam cycle



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Process	Methane Partial Oxidation – POX (Gasification)	Allam cycle oxy-fuel combustion for syngas	Allam cycle oxy-fuel combustion of methane	Methane combustion (Thermal oxidation)
Oxygen feedstock	Oxygen from ASU at stoichiometric flow for partial oxidation	Oxygen from ASU at stoichiometric flow for complete syngas combustion	Oxygen from ASU and stoichiometric flow for complete methane combustion	Air fed in excess
Energy required/released	Exothermic, steam generation, hot syngas	Exothermic, working fluid temperature is increased	Exothermic, working fluid temperature is increased	Exothermic, steam generation
Chemical reaction	$2\text{CH}_4 + \text{O}_2 \rightarrow 2\text{CO} + 4\text{H}_2$ (ideal case)	$2\text{CO} + 4\text{H}_2 + 3\text{O}_2 \rightarrow 2\text{CO}_2 + 4\text{H}_2\text{O}$	$\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$	$\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$ (ideal case)
Carbon product	CO (and CO ₂ from side reactions)	CO ₂	CO ₂	CO ₂
Product gas pressure	40 to 80 bar	300 bar in the Allam cycle	300 bar in the Allam cycle	Atmospheric pressure
Product gas temperature	~1,400 °C	1,700 °C in the Allam cycle at the burner exit and 1,150 °C after dilution with recirculated CO ₂	1,700 °C in the Allam cycle at the burner exit and 1,150 °C after dilution with recirculated CO ₂	~1,400 °C