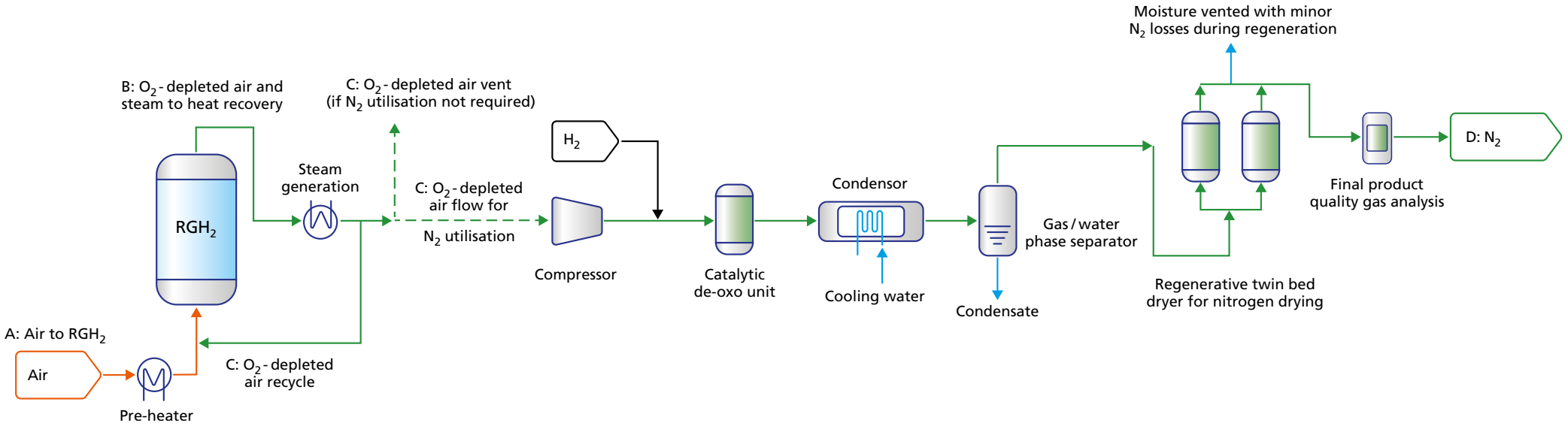
Stage 3: Air oxidation and oxygen-depleted air generation.
Oxidation of the RGH_2 oxygen-carrier with air (with option for nitrogen purification).

sbh4 consulting



Key reactions in the RGH_2 plug-flow, iron-oxide chemical looping reactor

$2Fe_3O_4 + ½O_2 \leftrightarrow 3Fe_2O_3^*$

* This non reversible reaction ensures complete conversion of the H_2 and CO over the iron-oxide during the stage 1. This enables separation of CO_2 and H_2O by condensation of H_2O to leave a stream with predominantly CO_2.

Biogas / Landfill gas feed Stream	O_2 Mol%	N_2 Mol%	H_2O Mol%	Temp °C
A: Air to RGH_2	21	79	0	185
B: O_2-depleted air and steam heat recovery	0–8	92–100	0	923
C: Cool O_2-depleted air	0–8	92–100	0	Ambient
D: High purity, dry N_2 product**	0.025	99.95	0.025	Ambient

BFG / BOFG Feed Stream	O_2 Mol%	N_2 Mol%	H_2O Mol%	Temp °C
A: Air to RGH_2	21	79	0	160
B: O_2-depleted air and steam heat recovery	0–8	92–100	0	853
C: Cool O_2-depleted air	0–8	92–100	0	Ambient
D: High purity, dry N_2 product**	0	99.95	0.025	Ambient

** Composition shown is indicative if the De-Oxo unit is run with slight excess of oxygen. As an alternative, the De-Oxo unit could be run with an excess of hydrogen to produce forming gas (Nitrogen with circa 2% hydrogen and zero oxygen content).