Urban Biogas Workshop
“Biogas upgrading”
- Technology overview -

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Urban Biogas Workshop, Riga/Latvia, 2012-10-25

[Haase Energietechnik AG, 2011]

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Biogas upgrading…

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2. Technology description:
    a. PSA
    b. Water Scrubber
    c. “Amine” scrubber
    d. Genosorb® scrubber
    e. Membrane separation
    f. Cryogenic upgrading

1.) What‘s biomethane?

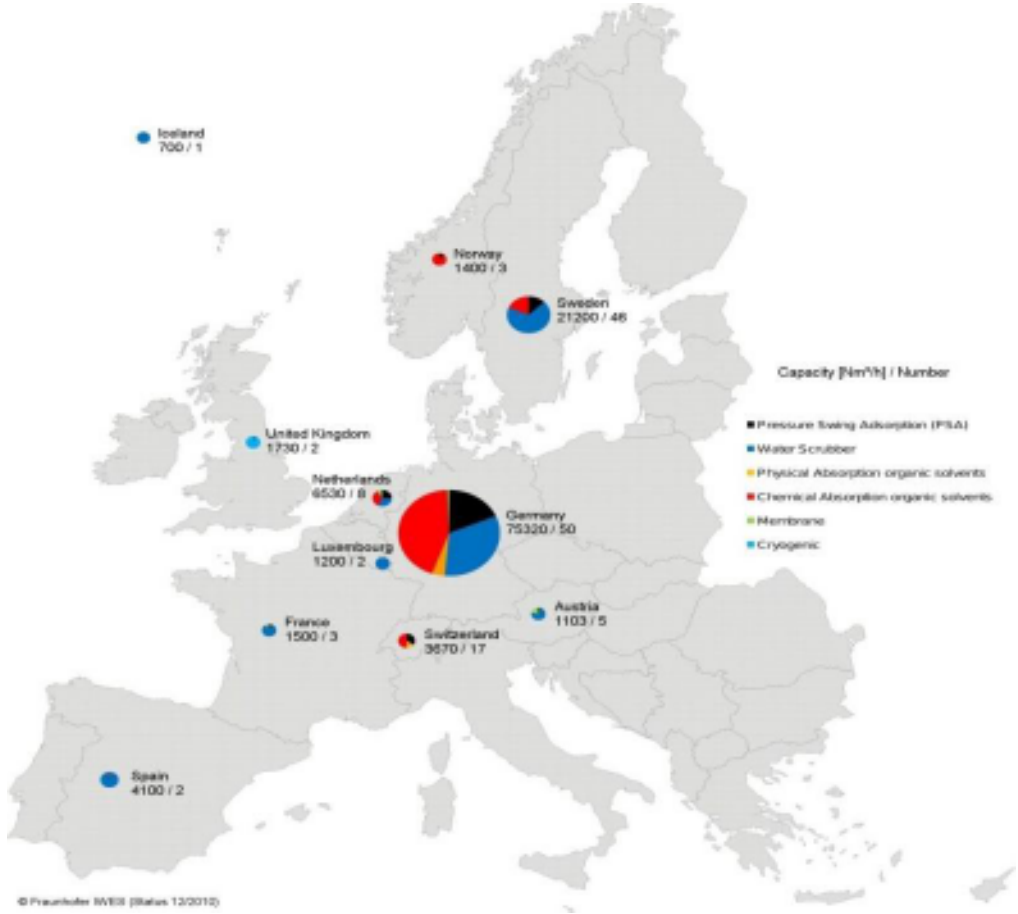
Biomethane is a cleaned (free of H_2S, water, etc.)

→ *mostly used activated carbon*

and upgraded (nearly free of CO_2) biogas.

→ The removing of CO_2 is the main task!

1.) Overview biogas upgrading plants and technologies in Europe



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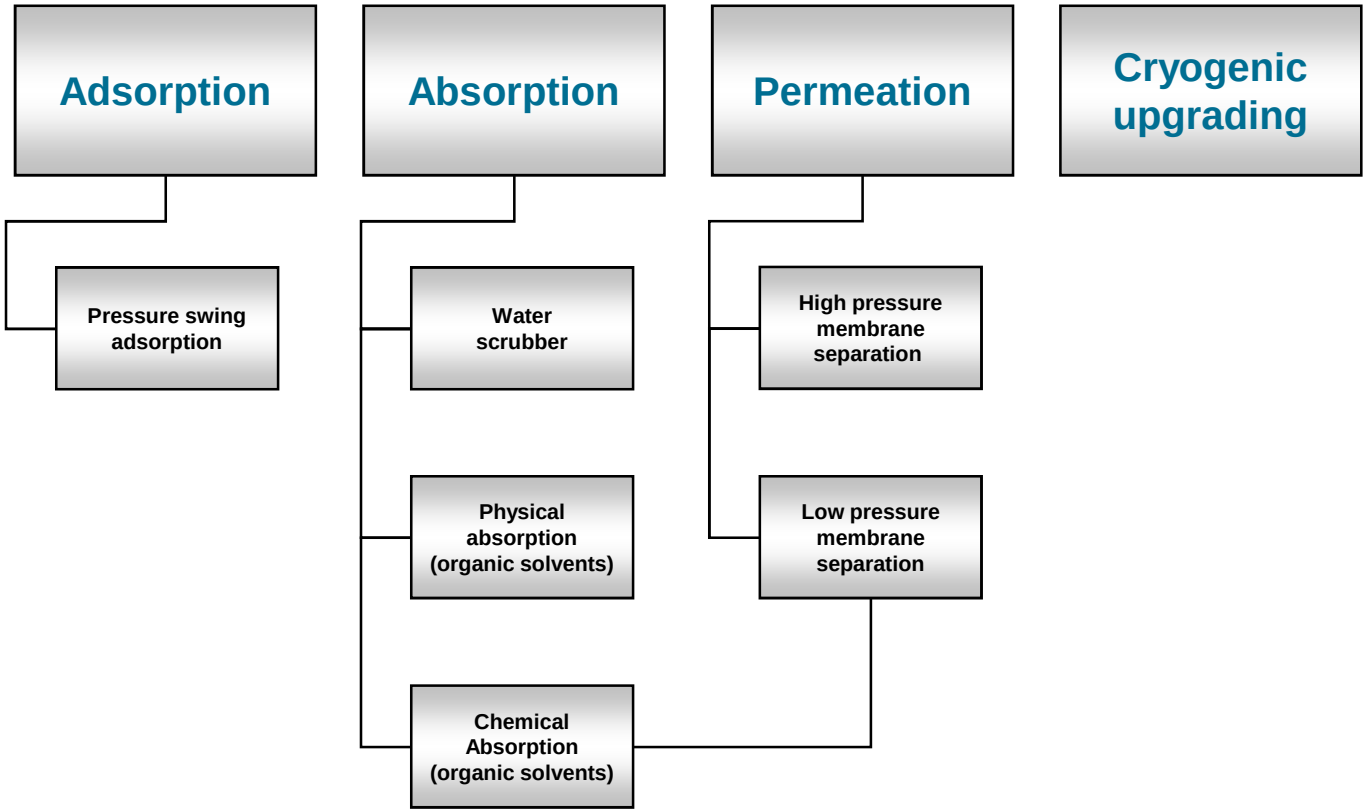
1.) Biogas upgrading – technology overview



[ISET, 2008]

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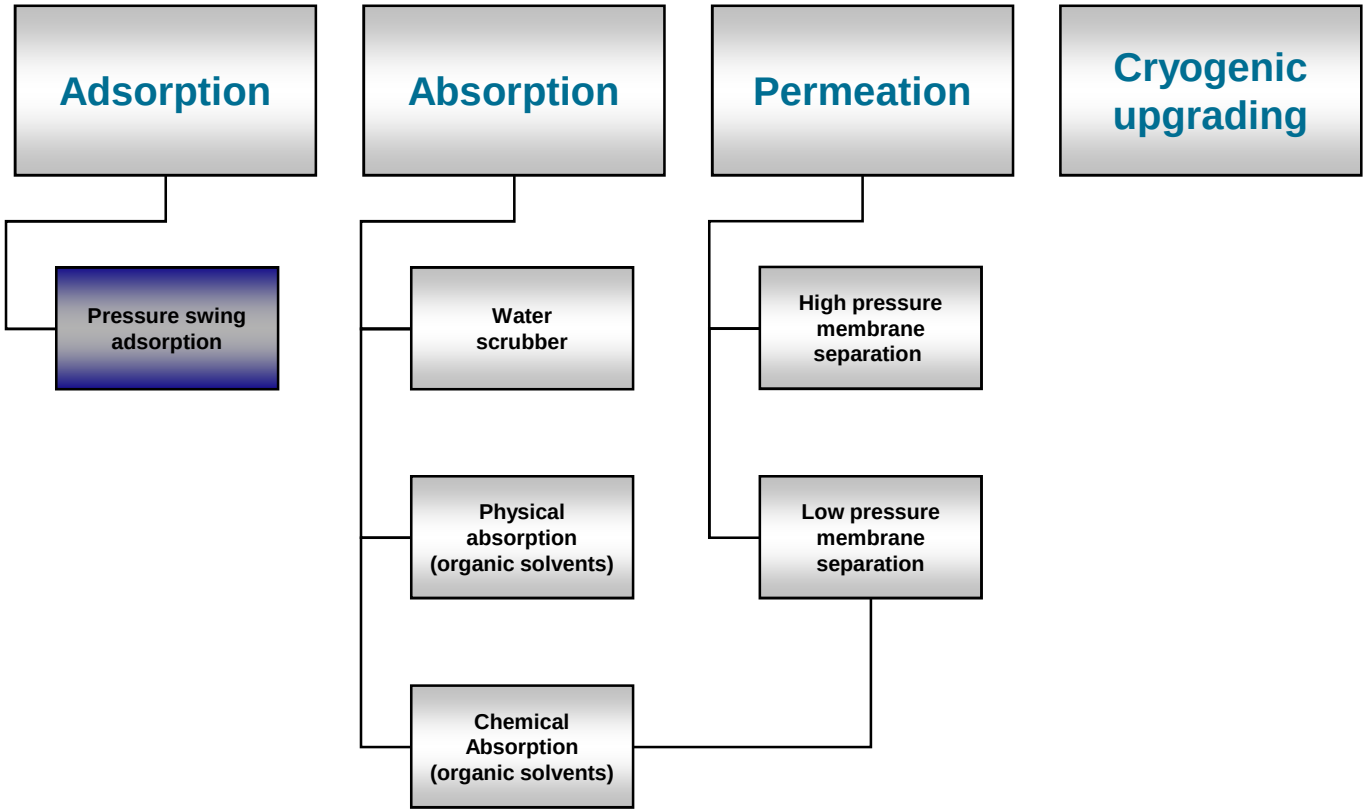
2 a) Pressure Swing Adsorption



[ISET, 2008]

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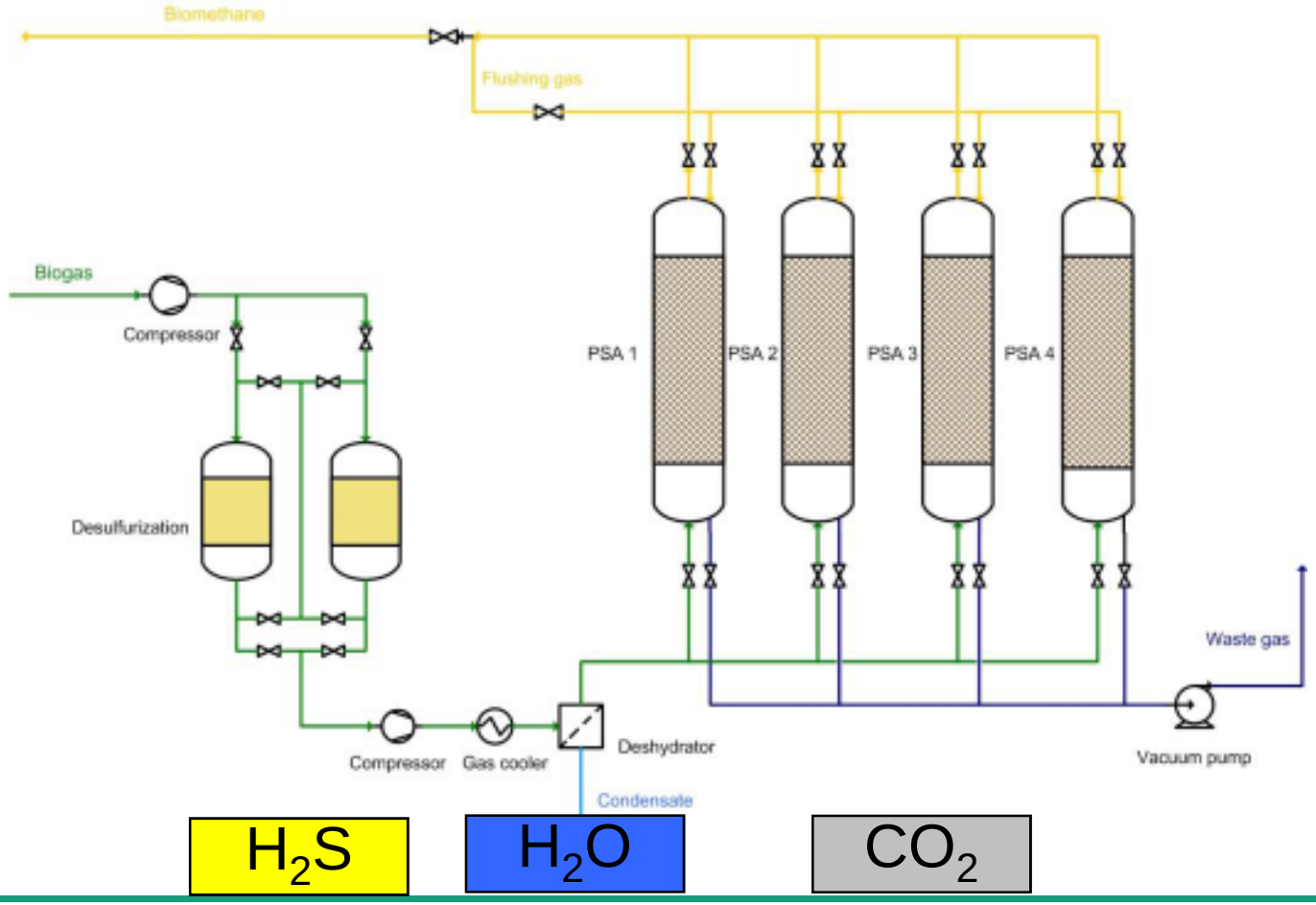
2 a) Pressure Swing Adsorption



[ISET, 2008]

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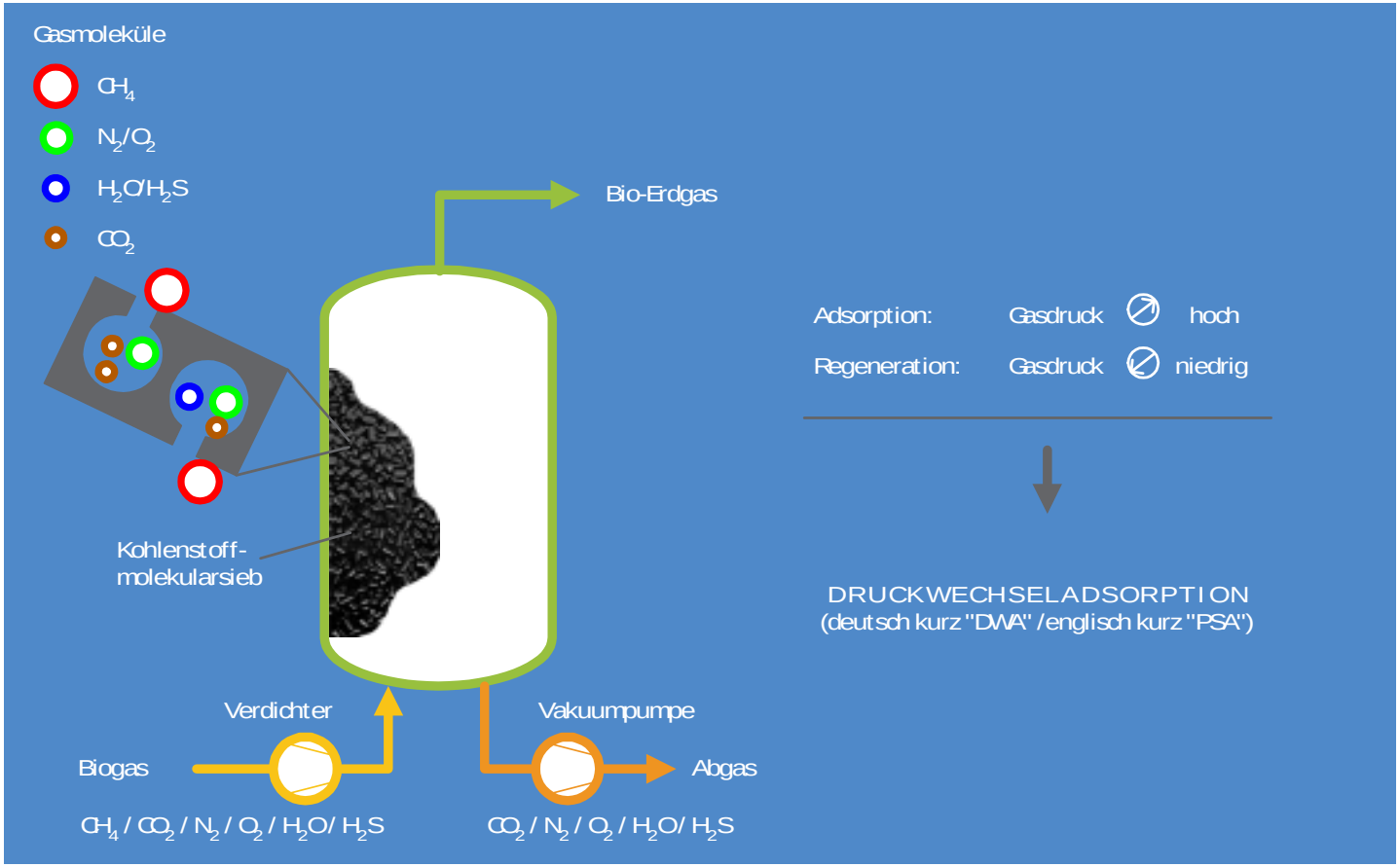
2 a) Pressure Swing Adsorption



[CarboTech, 2008]

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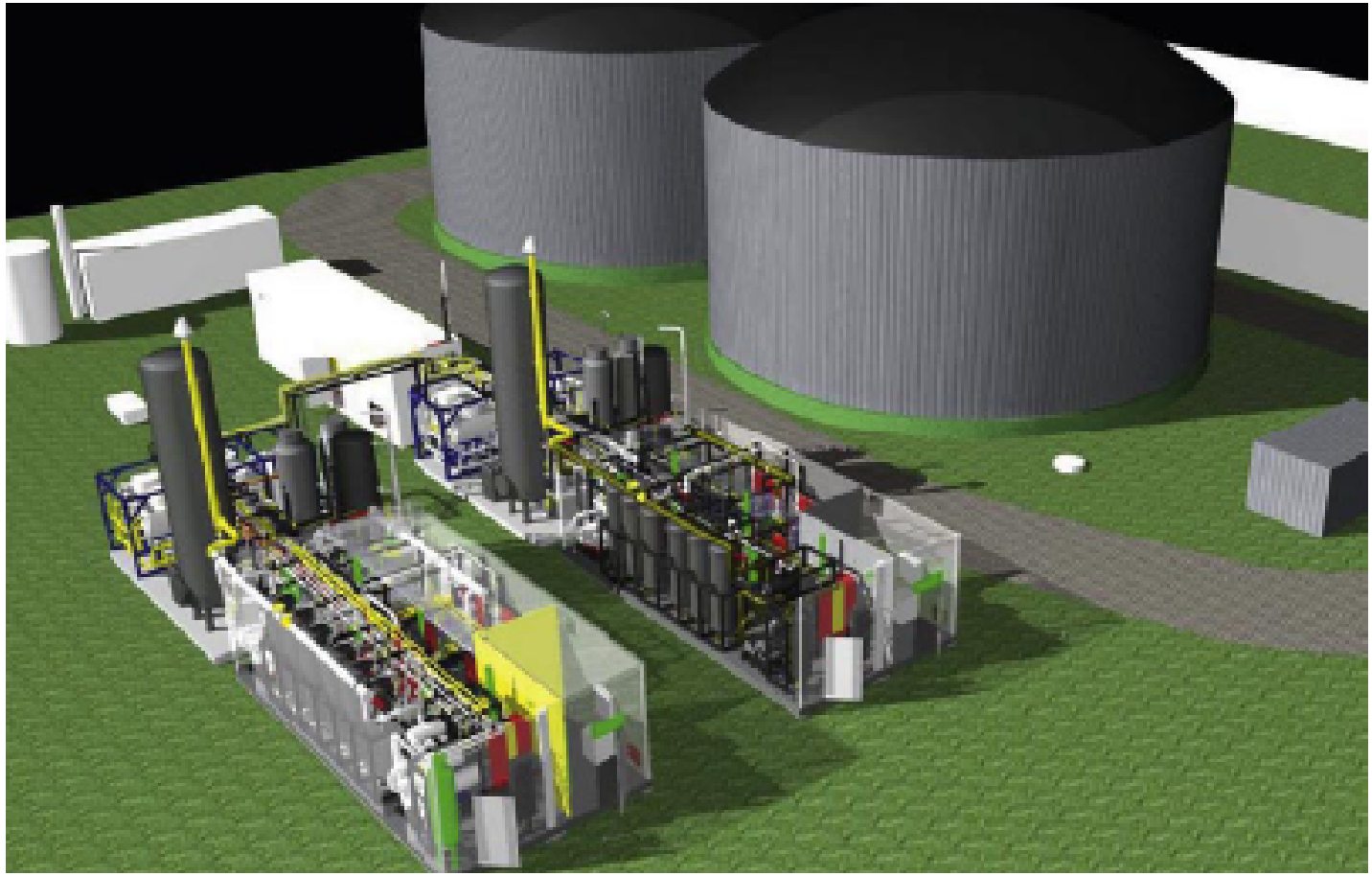
2 a) Pressure Swing Adsorption

[IWES, 2010]

Pressure Swing Adsorption: 2000 m_n^3/h

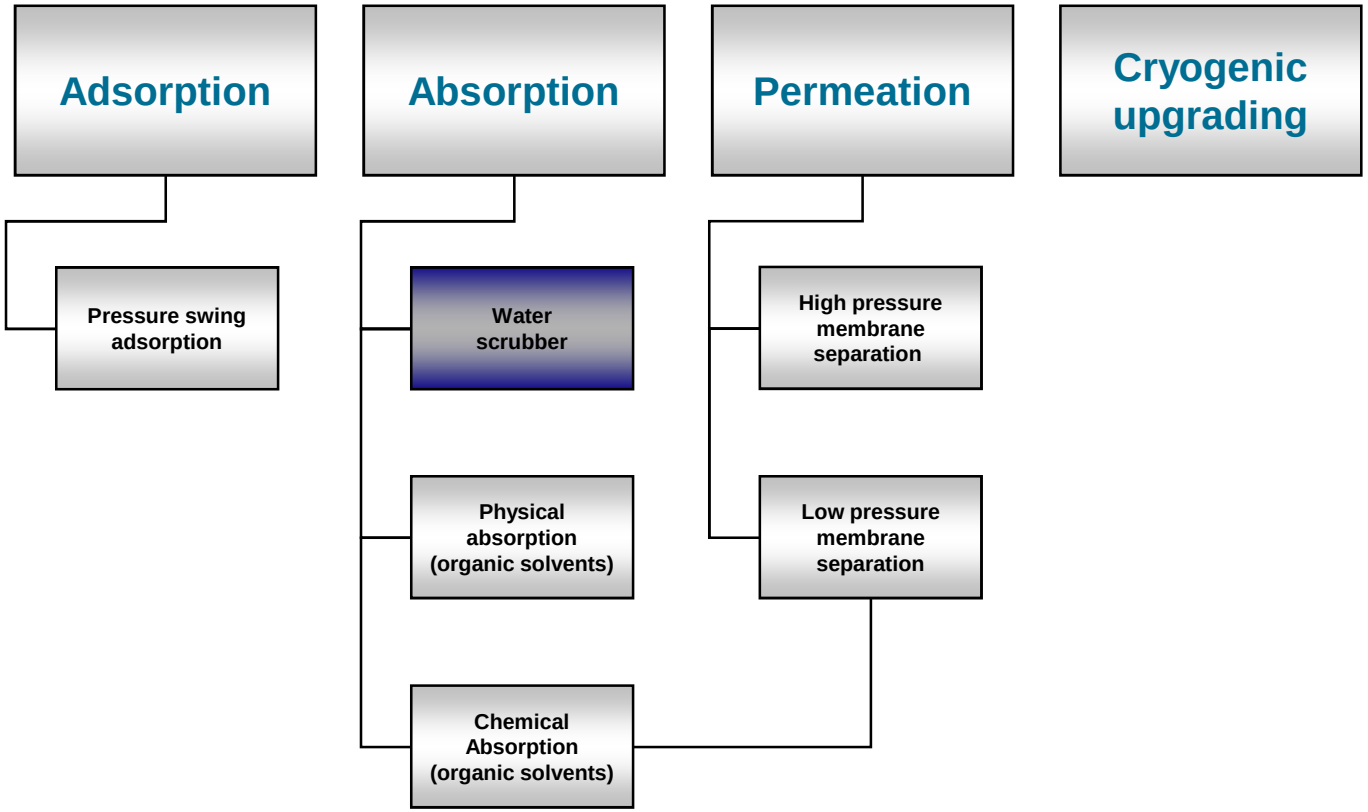


[CarboTech, 2008]

Key parameters upgrading technologies

		PSA	Water scrubber	Physical absorption (organic solvents)	Chemical absorption (organic solvents)	Membrane (high pressure, dry)	Cryogenic
Electricity demand	[kWh/m^3_{BG}]	**~ 0,2 - 0,25**	~ 0,2 - 0,3	0,23-0,33	>0,10	~ 0,25	0,18-0,33
Heat demand (temperature level)	[°C]	**No**	No	55-80	~ 160	No	No
Operation pressure	[bar]	**4-7**	5-10	4-7	0,1	5-10	
Methane loss	[%]	**1-5**	0,5 - 2	1-4	0,1		0,5 (?)
Exhaust gas treatment suggested (methane loss >1%)		**Yes**	Yes	Yes	No	Yes	Yes
Precision desulphurization required		**Yes**	No	No	Yes	Suggested	Yes
Water demand		**No**	Yes	No	Yes	No	No
Demand on chemical substances		**No**	No	Yes	Yes	No	No

2 b) Water scrubber



[ISET, 2008]

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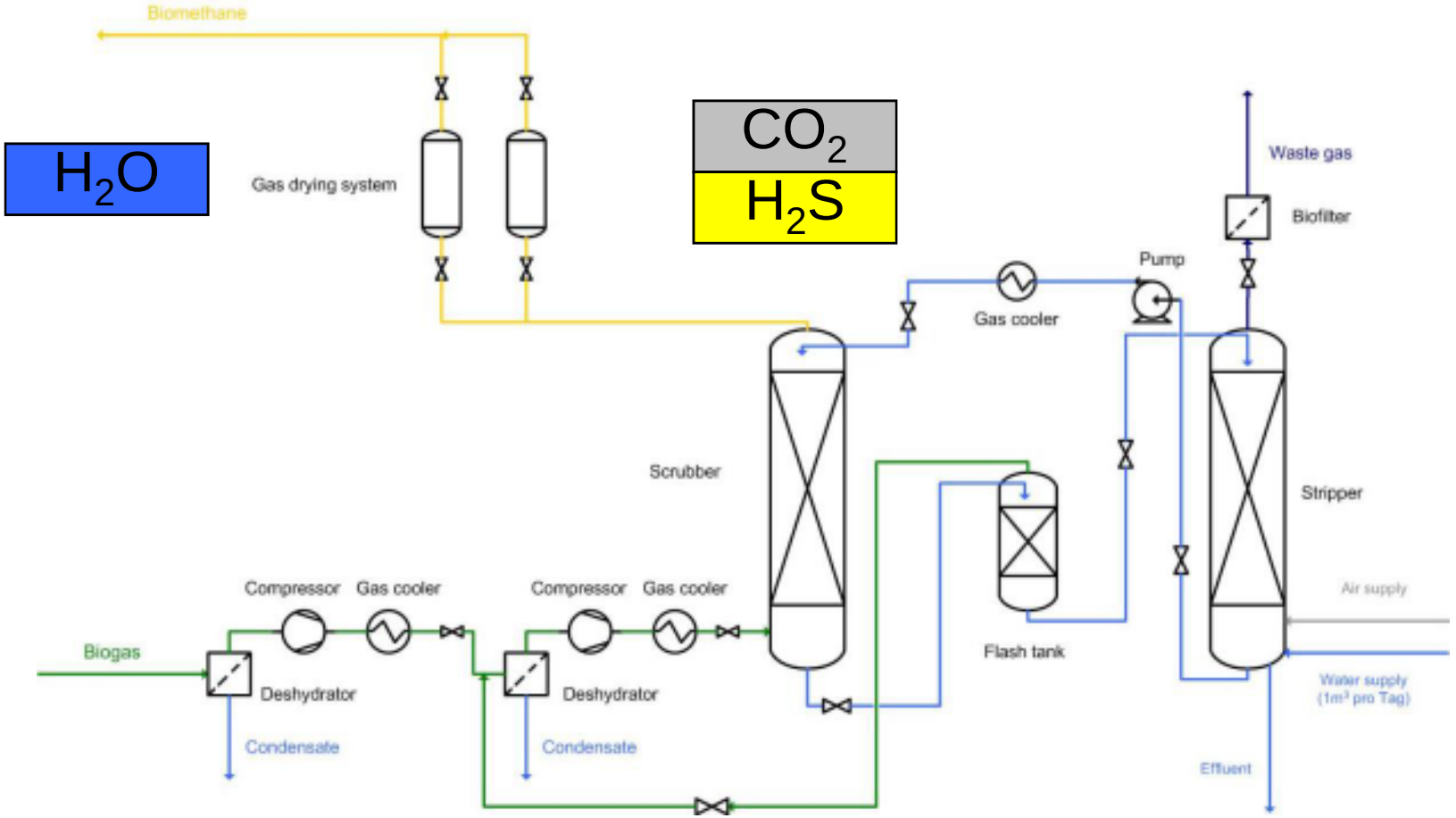
2 b) Water scrubber (with regeneration)



[ISET, 2009]

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2 b) Water scrubber (with regeneration)

[IWES]

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2 b) Water scrubber (with regeneration)

[IWES, 2011]

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Precision desulphurization required		Yes	**No**	No	Yes	Suggested	Yes
Water demand		No	**Yes**	No	Yes	No	No
Demand on chemical substances		No	**No**	Yes	Yes	No	No

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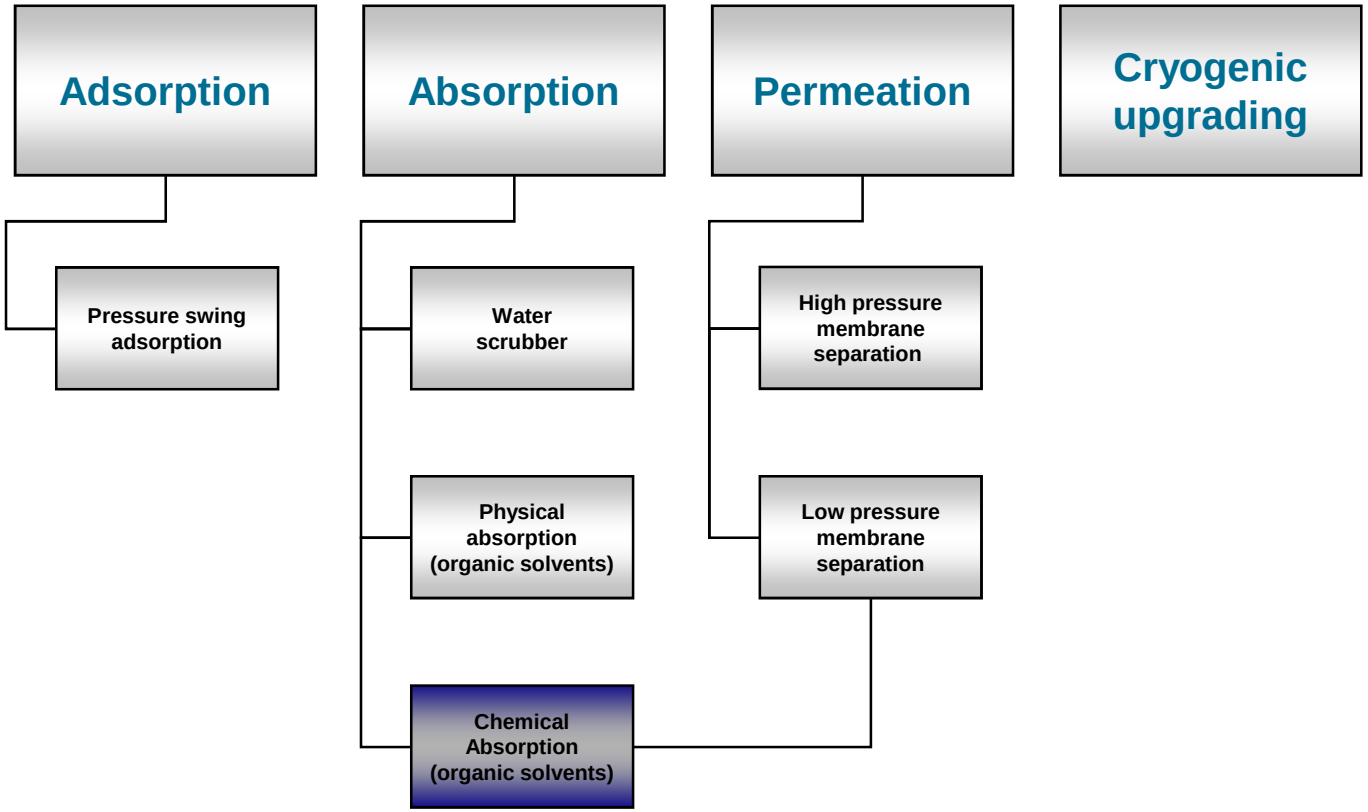
2 c) Chemical Absorption (using organic solvents) → *Amine scrubber*



[ISET, 2008]

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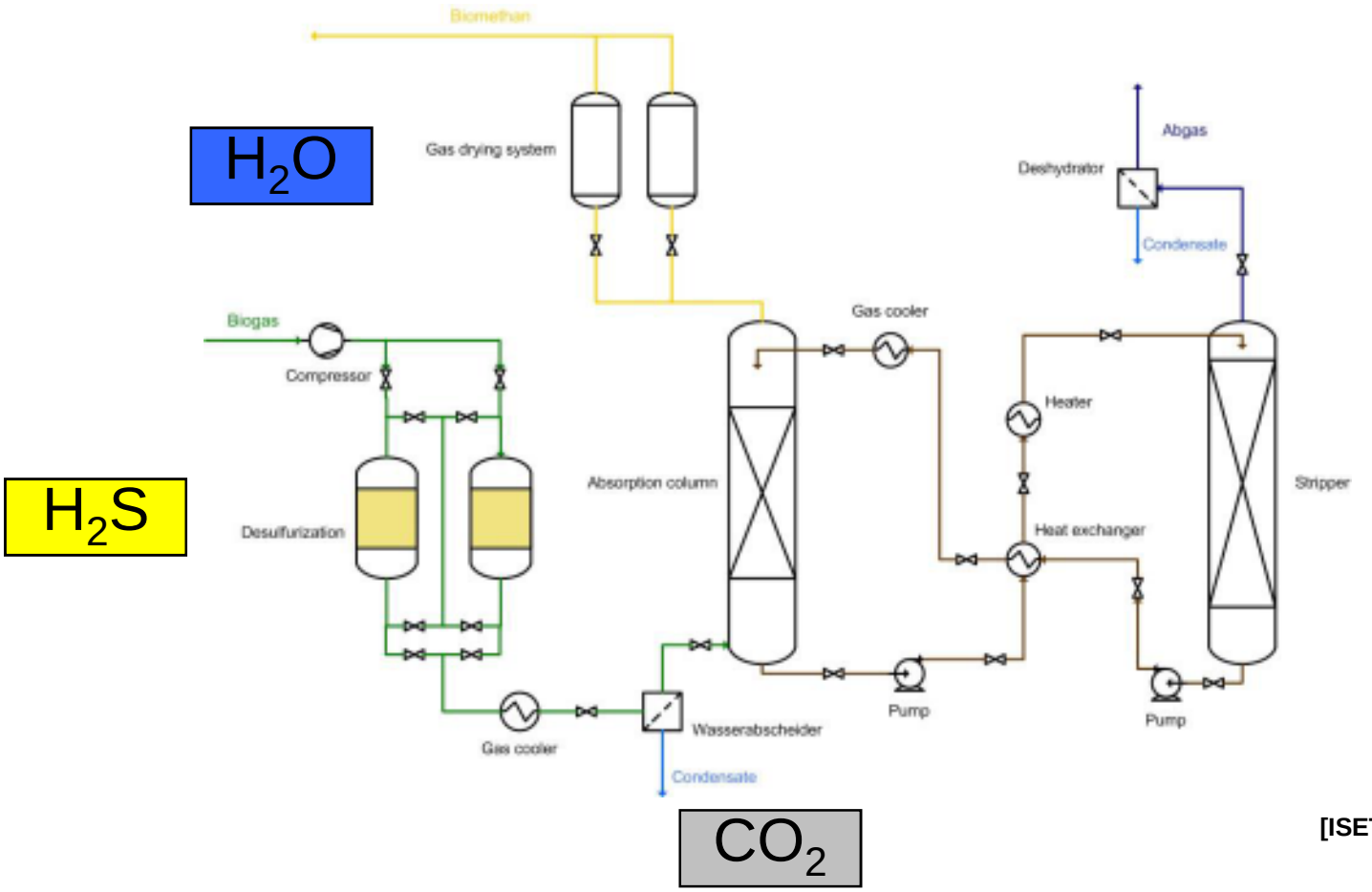
2 c) Chemical Absorption (using organic solvents)



[ISET, 2009]

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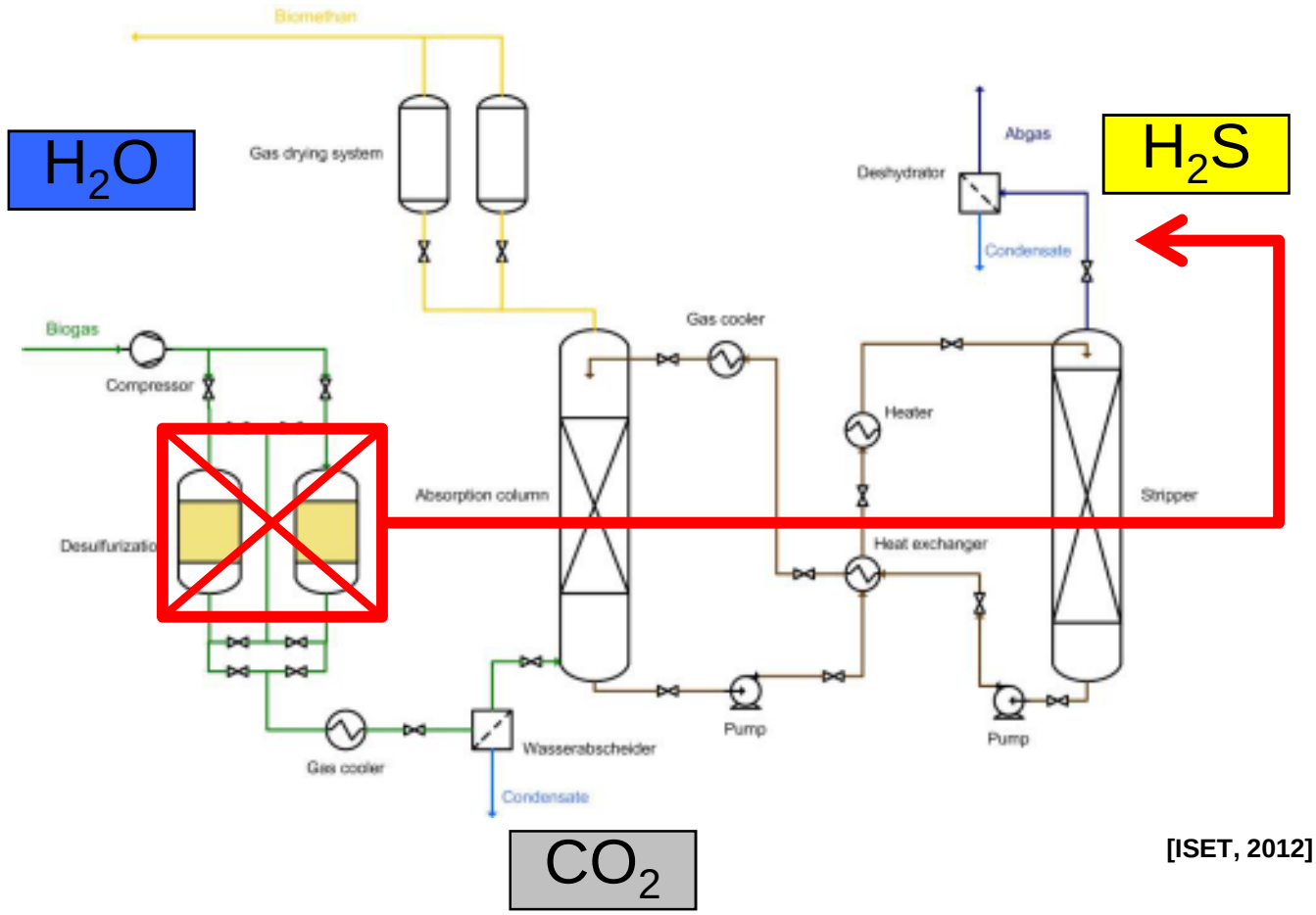
2 c) Chemical Absorption (using organic solvents): New developments (System BIS EMS)



[ISET, 2012]

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2 c) Chemical Absorption (using organic solvents)

[IWES]

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Precision desulphurization required		Yes	No	No	**Yes**	Suggested	Yes
Water demand		No	Yes	No	**Yes**	No	No
Demand on chemical substances		No	No	Yes	**Yes**	No	No

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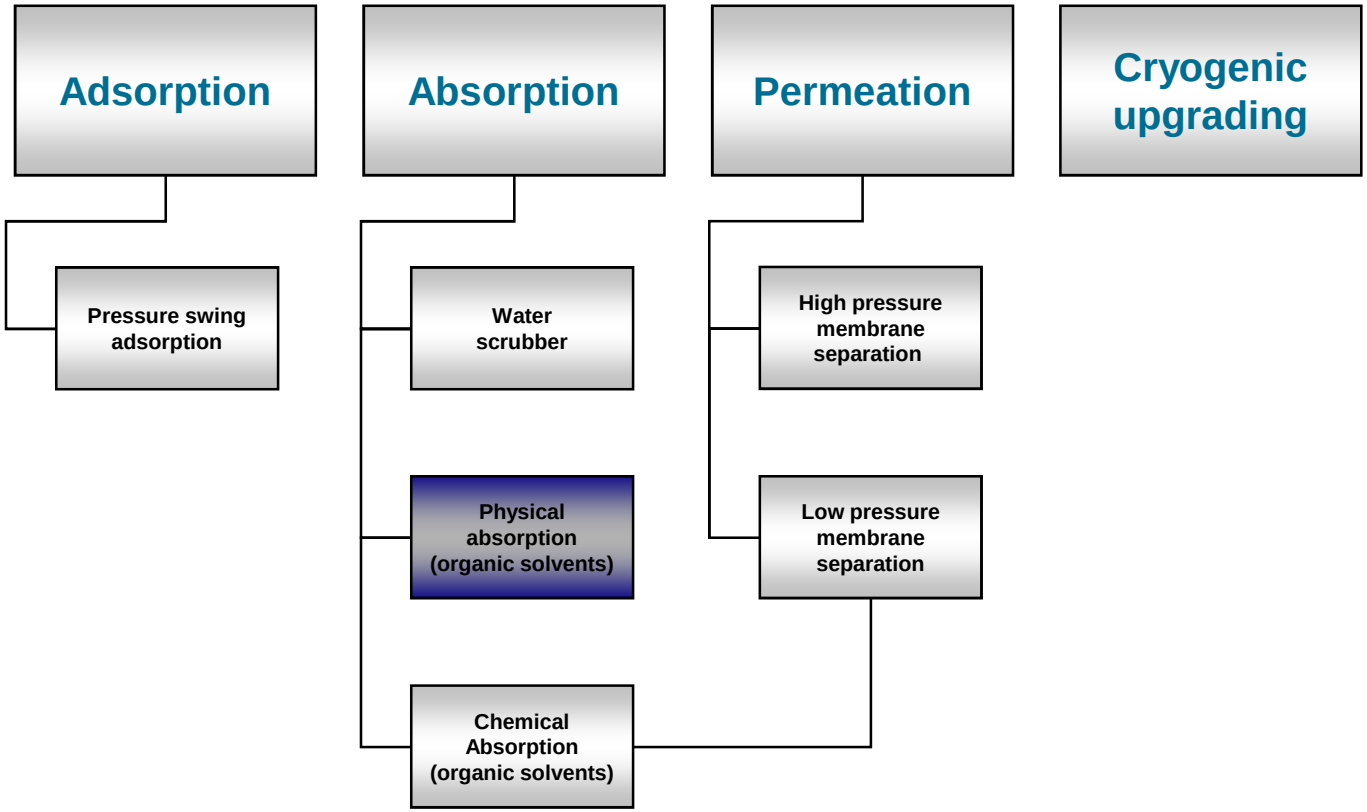
2 d) Physical Absorption (using organic solvents) → *Genosorb® scrubber*



[ISET, 2008]

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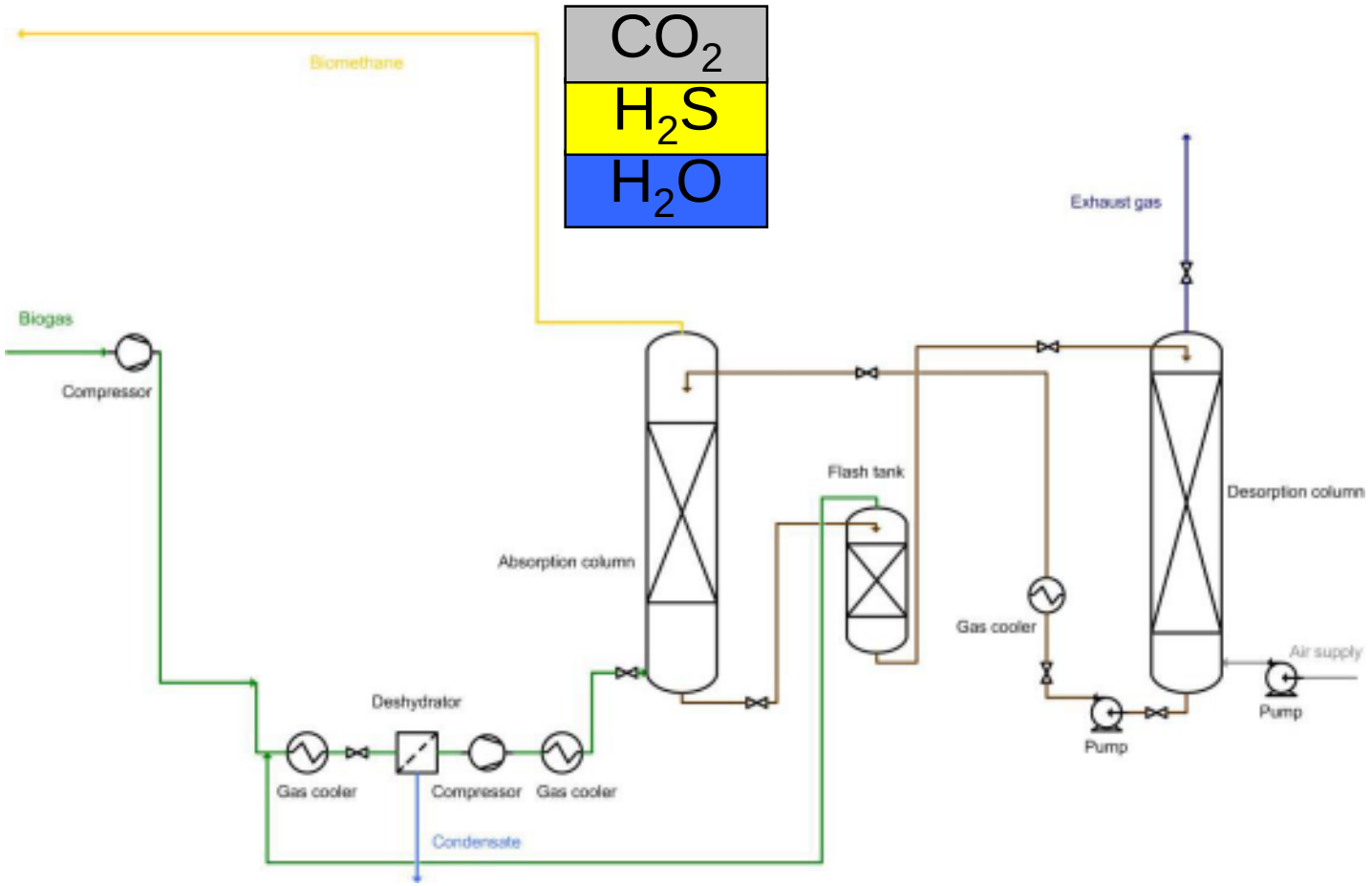
2 d) Physical Absorption (using organic solvents)



[ISET, 2009]

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2 d) Physical Absorption (using organic solvents)

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Precision desulphurization required		Yes	No	**No**	Yes	Suggested	Yes
Water demand		No	Yes	**No**	Yes	No	No
Demand on chemical substances		No	No	**Yes**	Yes	No	No

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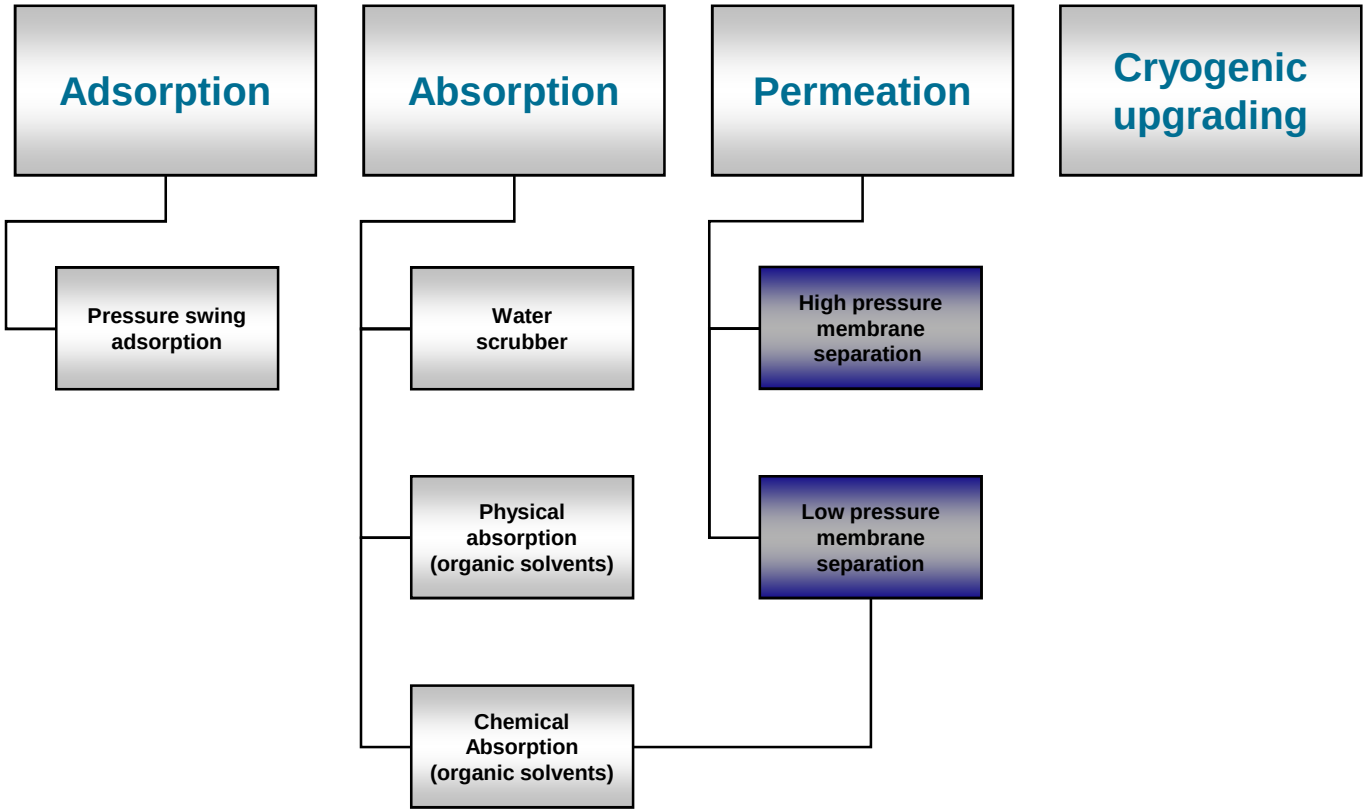
2 e) Membrane separation / Permeation



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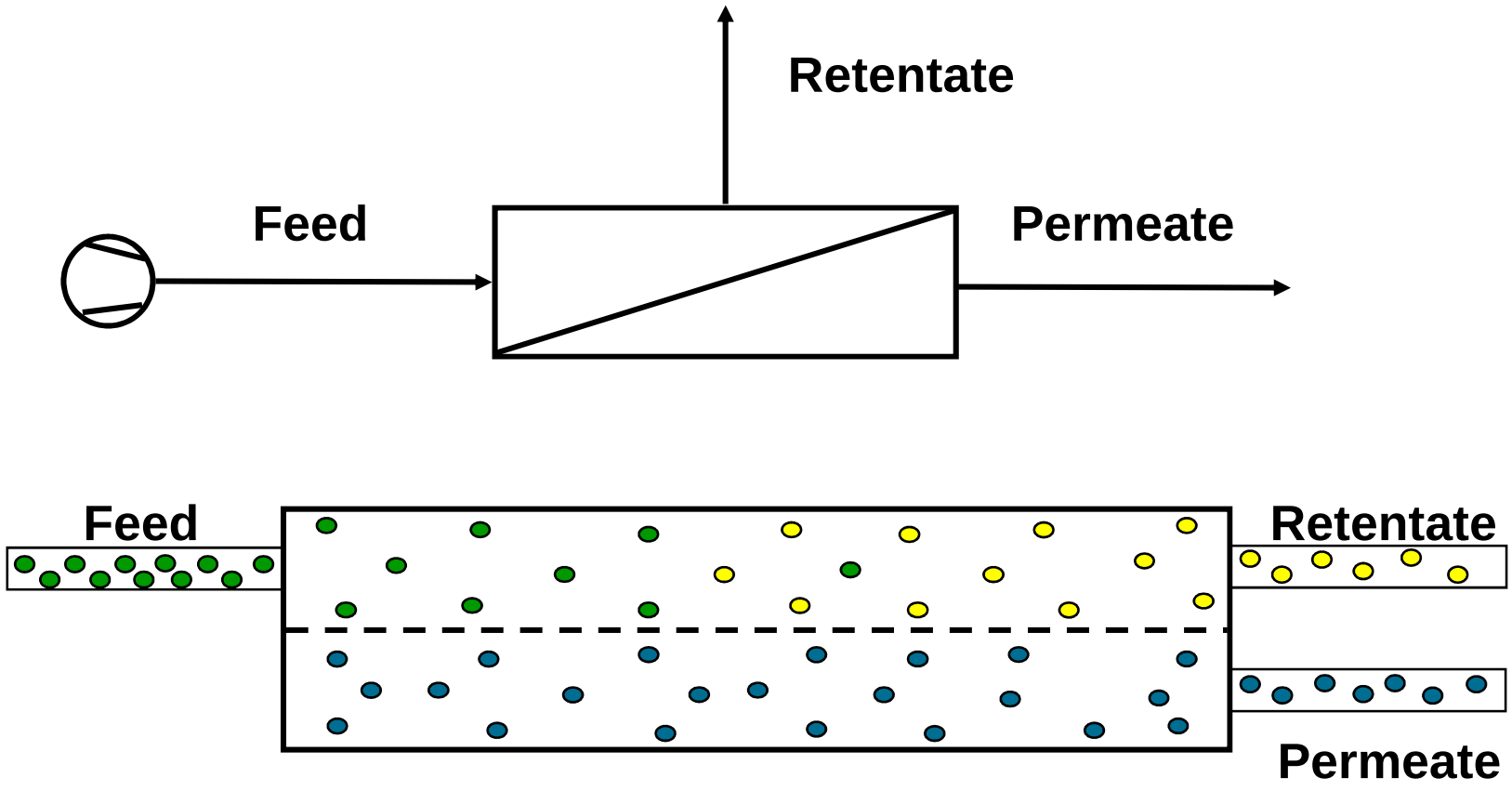

[ISET, 2008]

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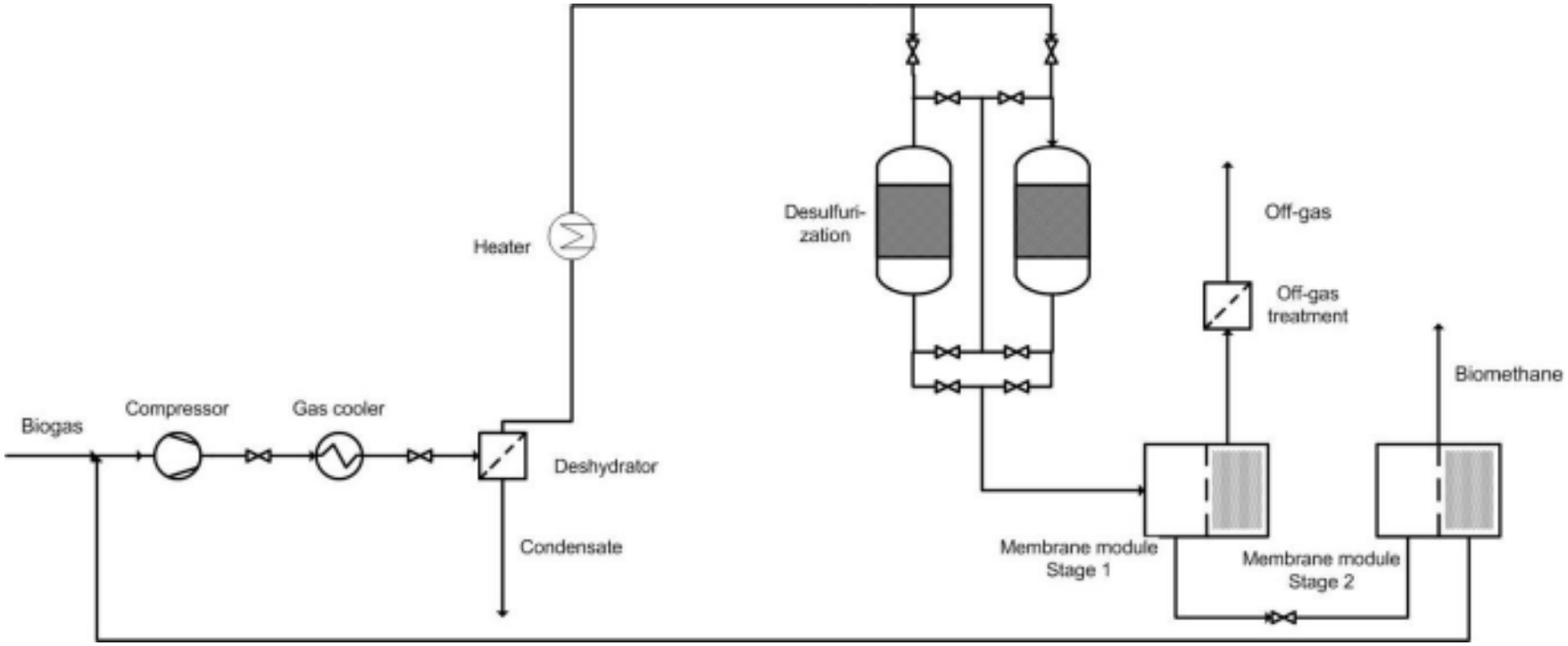

[IWES]

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2 e) Membrane separation / Permeation

[IWES, 2011]

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[IWES, 2011]

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Precision desulphurization required		Yes	No	No	Yes	**Suggested**	Yes
Water demand		No	Yes	No	Yes	**No**	No
Demand on chemical substances		No	No	Yes	Yes	**No**	No

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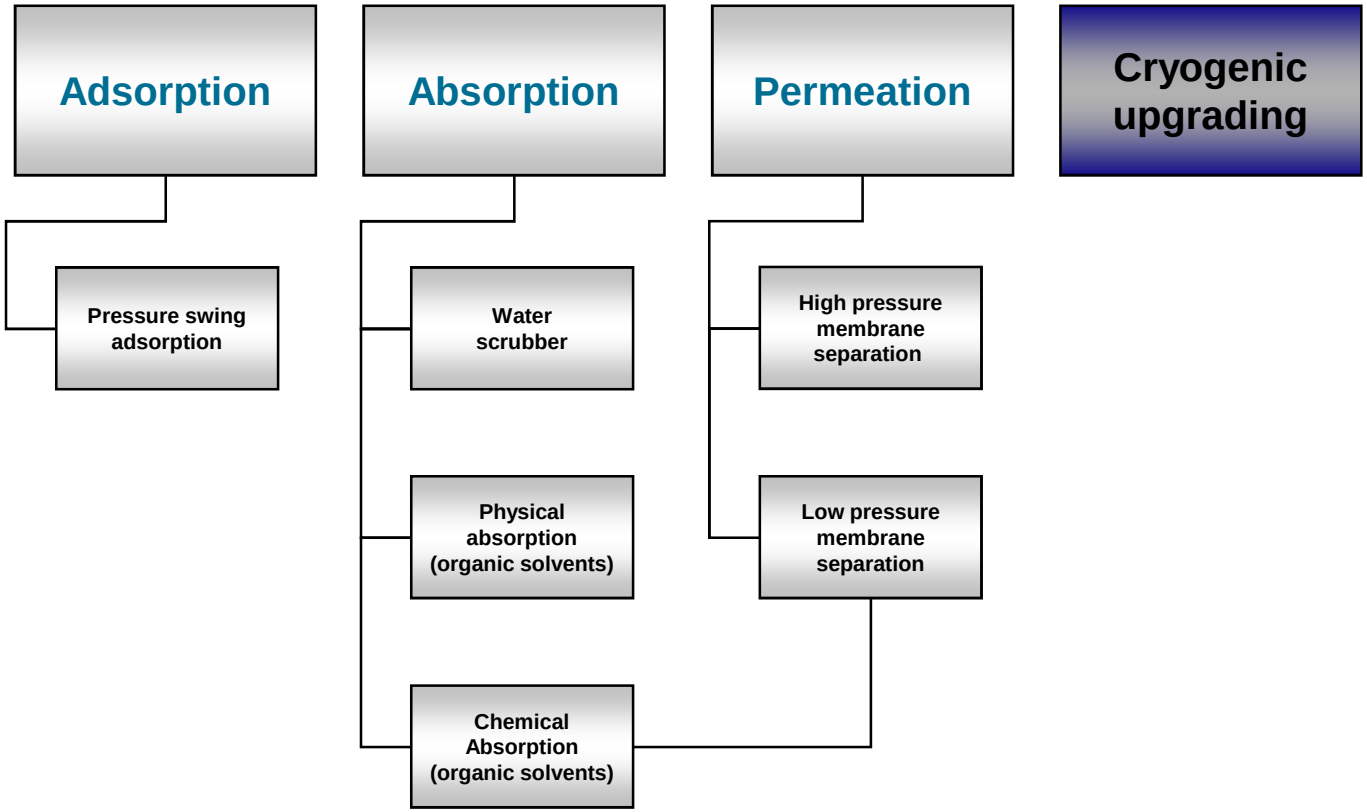
2 f) Cryogenic technologies



[ISET, 2008]

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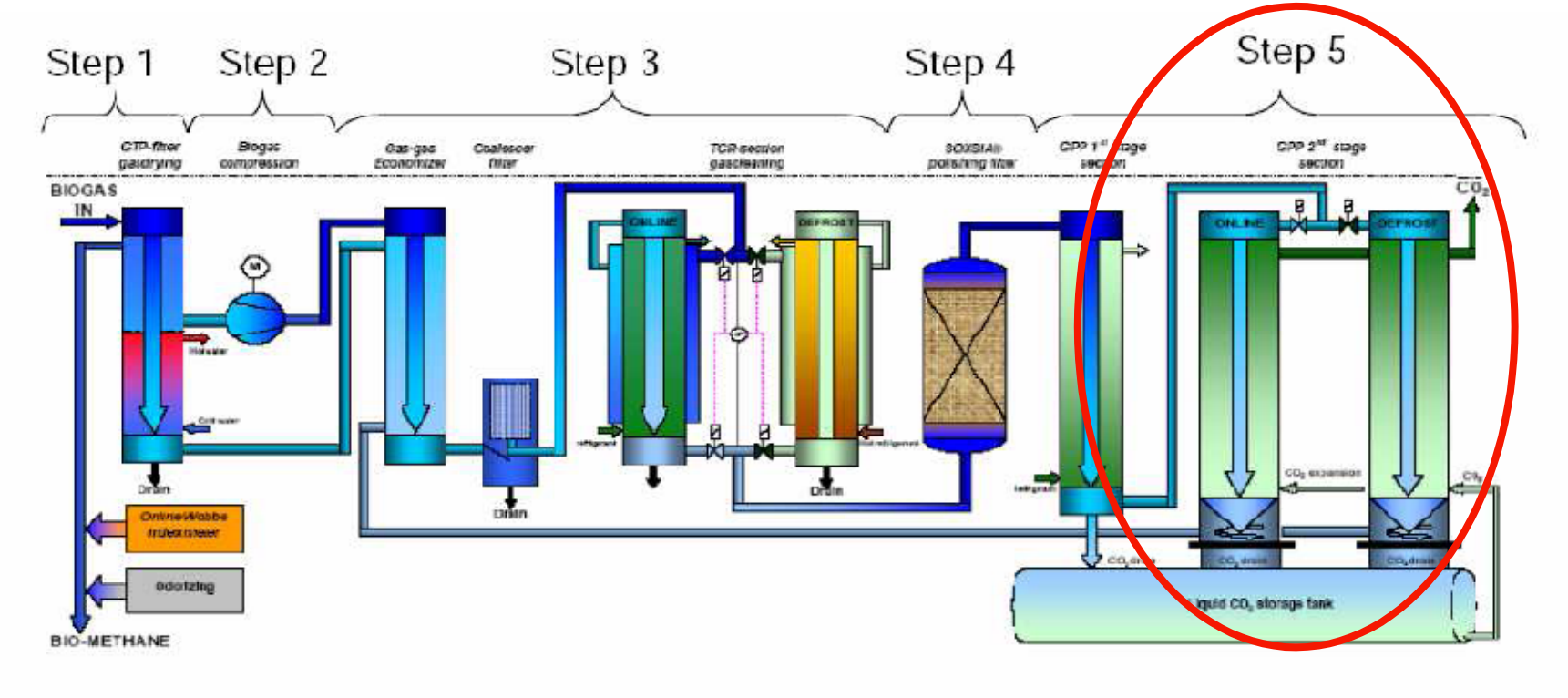
2 f) Cryogenic technologies (System: GPP® of GTS)



[GTS, 2008]

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Many thanks for your attention….

Questions?

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