50 Years
Gas Treating Excellence
est. 1971

OASE®

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We create chemistry

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Turning Energy Blue with Zero CO_2 Emissions

Tiffany Chen, Mohamed Anas

10/8/2024

Our purpose:

We create chemistry for a sustainable future

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We create chemistry for a sustainable future – BASF's emission targets

2030

25%

Scope 1 and **Scope 2**

CO_2 emission reduction

(compared with 2018)

15%

specific **Scope 3.1**

CO_2 emission reduction

(compared with 2022)[1]

2050

net zero

Scope 1, Scope 2 and **Scope 3.1**

CO_2 emissions

[1] Corresponds to a reduction from 1.57 to 1.34 kilograms of CO2e per kilogram of raw material bought; calculated on the basis of relevant Scope 3.1 emissions of 48 million metric tons

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What we want to achieve

We want to be a thought and action leader in the area of sustainability.

We want to increase the role of sustainability in our business decisions.

We want to show how we add value to society along the value chain.

Key levers

1 Carbon Management Program

2 Circular Economy Program

3 Sustainable Solution Steering

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- OASE® is BASF‘s brand name for the entire portfolio of **Gas Treating Technologies** and their respective solvents and services.
- OASE is a **tailored offering** to match the objectives of each of our customer.
- OASE defines **state-of-the-art gas treating technology** for the respective industries in which it is marketed.
- OASE is the only truly **global brand** which can provide gas treatment process design, solvent supply and support services.

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OASE® Technologies and Industries

***OASE®* purple**	• LNG Pretreatment
***OASE®* white**	• Ammonia, Syngas
***OASE®* yellow**	• Sulfur Selective
***OASE®* blue**	• Flue gas
***OASE®* green**	• Biogas
***OASE®* sulfexx™**	• Super Selective Sulfur

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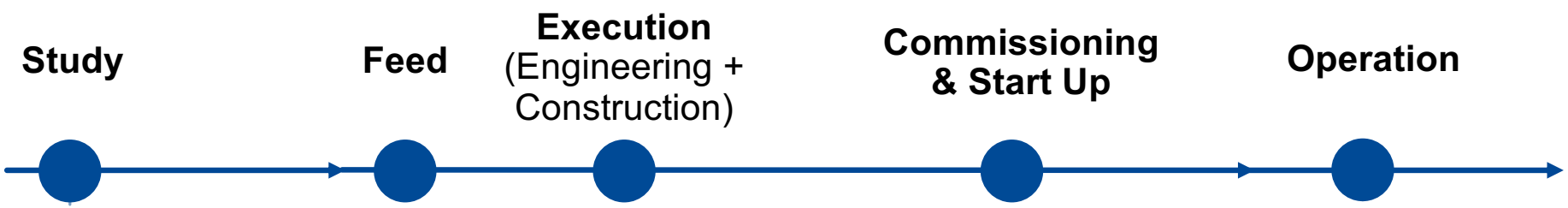
- HIPACT® JGC
- FLEXSORB™ ExxonMobil
- OASE® connect (digital platform)
- OASE® digilab (analytical tool)

Cradle to Grave Support



BASF

- Early discussion support
- Technical & commercial proposal with preliminary warranty values

BASF & Engineering Partner

- Reputable and trusted engineering partners globally
- Guidance on engineering design process

BASF

- Continuous tech support
- Solvent first fill & refills
- Sample analytic service

BASF present in all stages of customer journey

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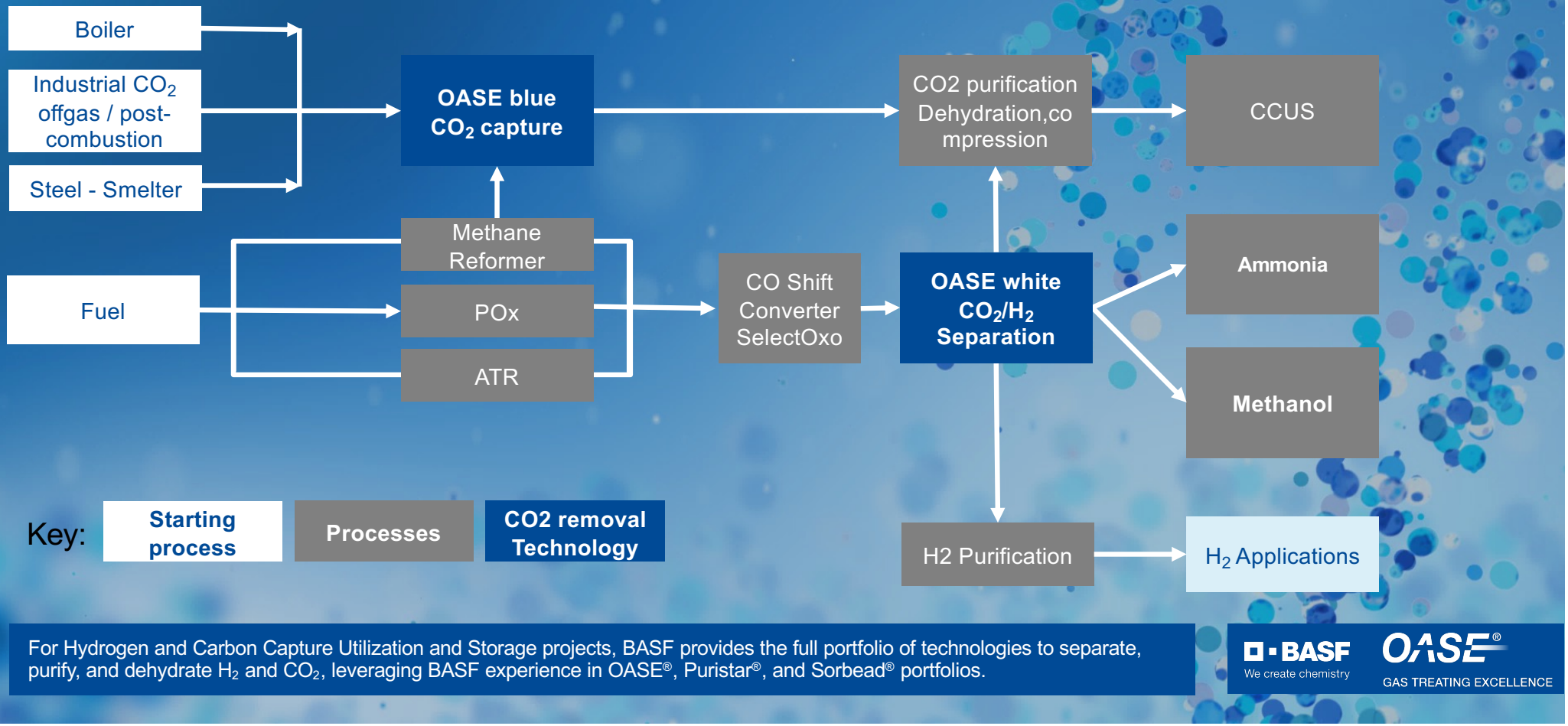
CO_2 Removal in energy production



For Hydrogen and Carbon Capture Utilization and Storage projects, BASF provides the full portfolio of technologies to separate, purify, and dehydrate H_2 and CO_2, leveraging BASF experience in OASE®, Puristar®, and Sorbead® portfolios.

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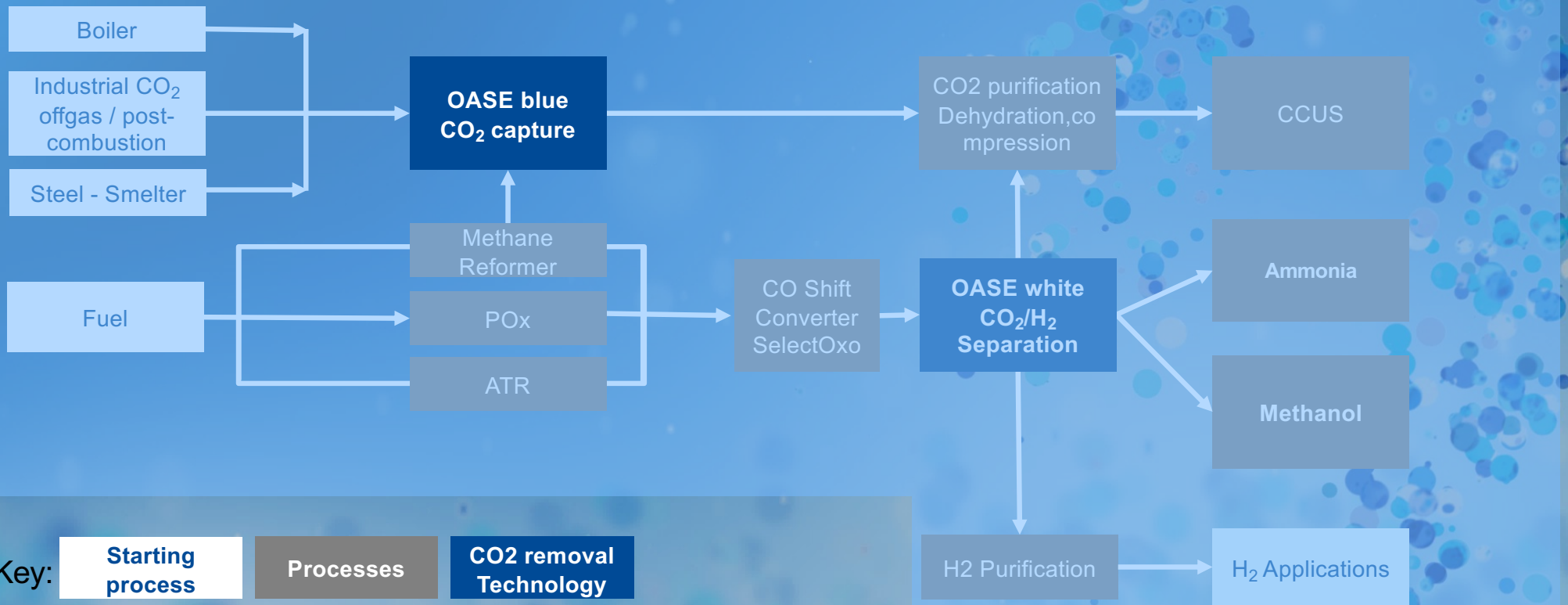
OASE blue

CO_2 Removal in energy production



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OASE blue Technology

Tailor-made solution to optimize large-scale post-combustion capture (PCC) installation

Power plants
Coal- or gas fired

Waste incineration
Municipal or biomass

Maritime
Engine off gas

Cement plants
Clinker calcination

Production
Steam Reformer (SMR)

Others
Steel-, Chemical-
Production, Refineries

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What is OASE® blue

Key Feature

- **Proven technology**
- **High capture rates**
- **Low energy & amine consumption**
- **Low environmental**
- **Wide applicability**

BASF OASE® blue technology offering

⇨ Commercial references and pilot plant testing completed worldwide

⇨ CO2 removal rate, up to **99%** with **> 99 vol%** CO2 purity

⇨ **2.5 - 3.0* GJ/to$_{CO2}$ // ~0.3 – 0.6 kg$_{amine}$/to$_{CO2}$**
*heat integration can further reduce this number

⇨ **OASE® aerozone** (Patented aerosol / emissions reduction zone)
⇨ Proven reclaimer concept

⇨ Tested range **O_2 (4 – 16 vol%)** / **CO_2 (4 – 25 vol%)**

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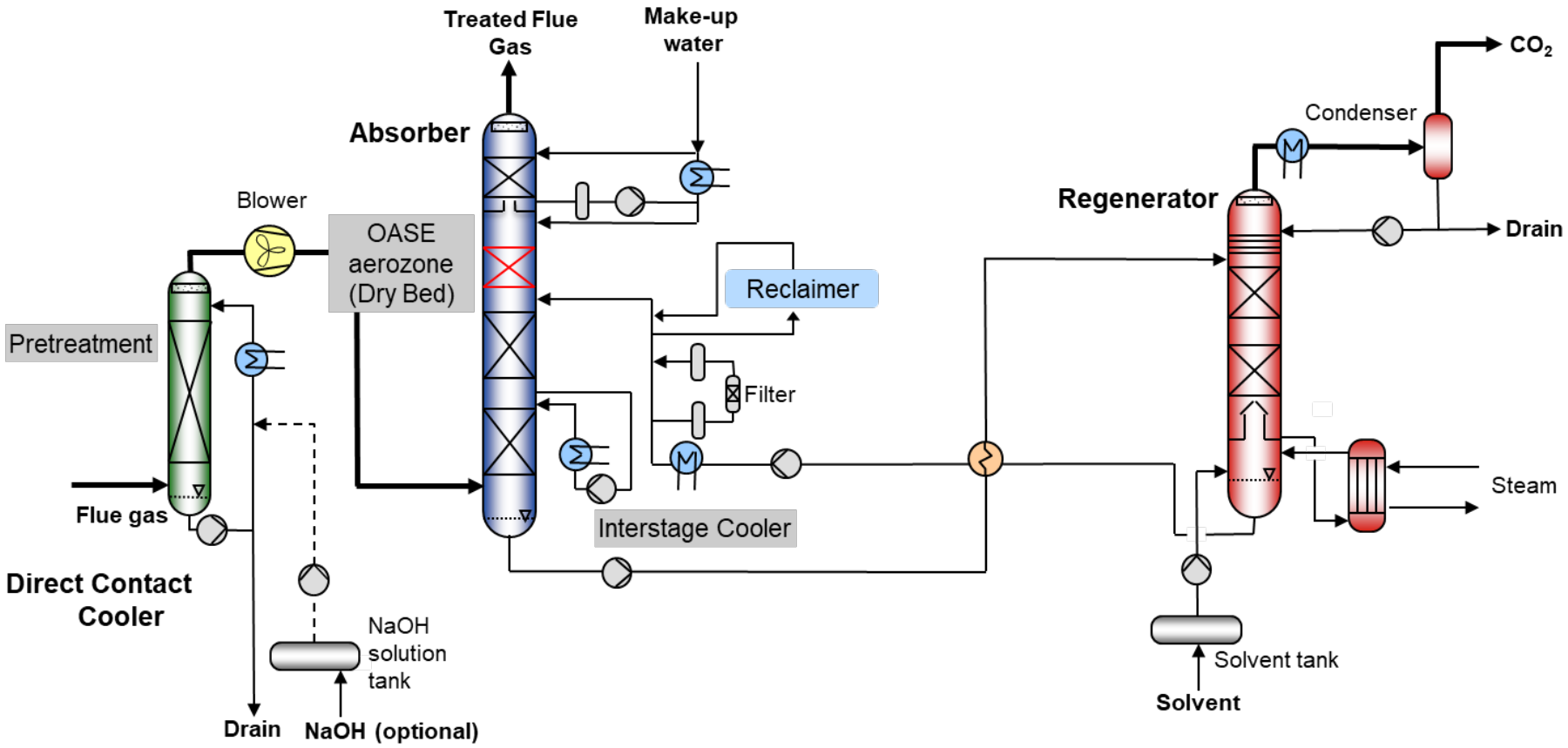
OASE® blue Flow Scheme



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Process Warranties

OASE® blue Pilot Plant at Wilsonville, US
Capacity: 30 TPD CO2 capture

- Minimum CO2 removal rate / production rate
- Maximum thermal energy consumption
- Solvent circulation rate
- Solvent make up
- **CO_2 purity**
- **Emission quality**

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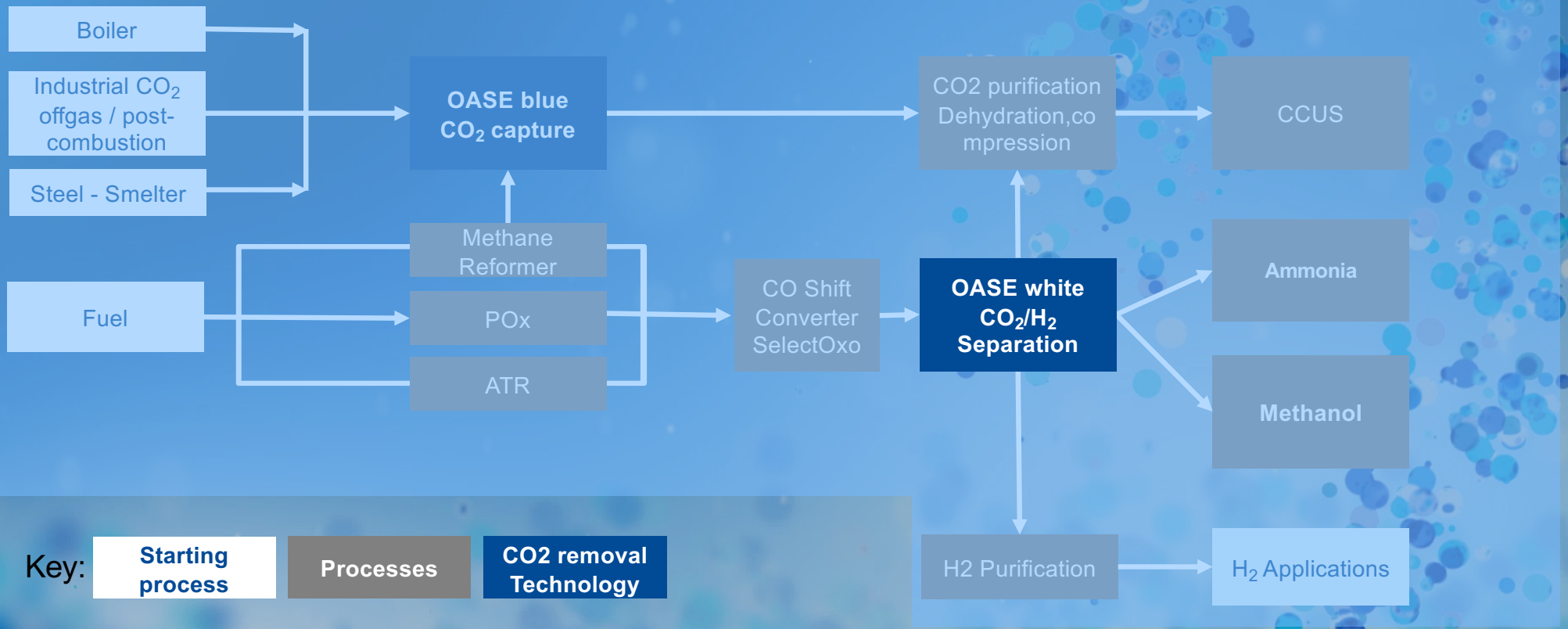
OASE white

CO_2 Removal in energy production



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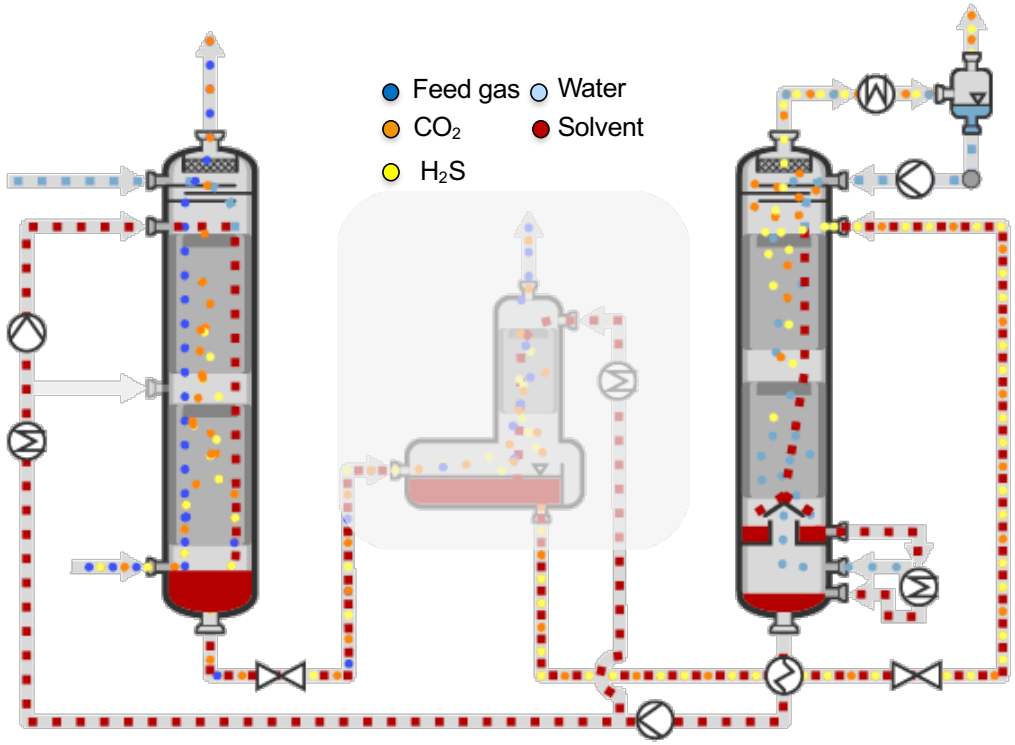
AGRU Process

- **Absorber:** counter current flow of feed gas and amine solution
  - Chemical Absorption of CO_2, H_2S, and COS by amine molecules
- **Stripper:** counter current flow of steam and amine solution
  - Thermal Desorption by depressurization and stripping
- **Aqueous amine solution:** carrier for acid gas



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Key streams summary:
Typical feed gas compositions to Absorber of OASE® unit

Technology for Hydrogen Production	Key streams summary Typical feed gas composition to Absorber of OASE® unit								
	CO_2, mol%	CO, mol%	H_2, mol%	O_2, mol%	N_2, mol%	CH_4, mol%	P, bara	CCR(*), %	Energy(**), GJ/toCO_2
PG CO_2, SMR	19.4	0.3	77.1	-	-	3.0	18.0	**99.99**	**1.2 / 2.0**
FG CO_2, SMR	22.5	-	-	2.1	74.5	-	1.1	**95**	**2.56**
TG CO_2, SMR	49.0	10.0	30.0	-	-	10.2	1.2	**90 / 99.99**	**2.0 – 3.1**
PG CO_2, ATR	23.2	0.5	73.8	-	-	2.2	25.0	**97**	**0.8**
PG CO_2, ATR+GHR	24.2	0.4	74.4	-	-	-	30.2	**99.99**	**0.69 – 1.1**
PG CO_2, POx	27.5	0.7	71.2	-	-	-	32.2	**99.99**	**0.6**

PG = Process Gas, TG = Tail Gas
(*)Carbon Capture Rate for specific OASE® unit depending on Customer requirement
(**) Specific thermal energy consumption; Selected design depends on requirement of minimum OPEX or CAPEX or combination of both

Elena Petriaeva and Bernhad Geis, Low Carbon hydrogen – a climate silver bullet, CRU 2023

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Benefit: Process Warranties

- Minimum CO2 removal rate / production rate
- Maximum thermal energy consumption
- Solvent circulation rate
- Solvent make up
- CO_2 purity
- CO2 component stream

Photo Copyright: JCCS Tomakomai, Japan
Actual setup of OASE® CO_2 Capture Unit

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