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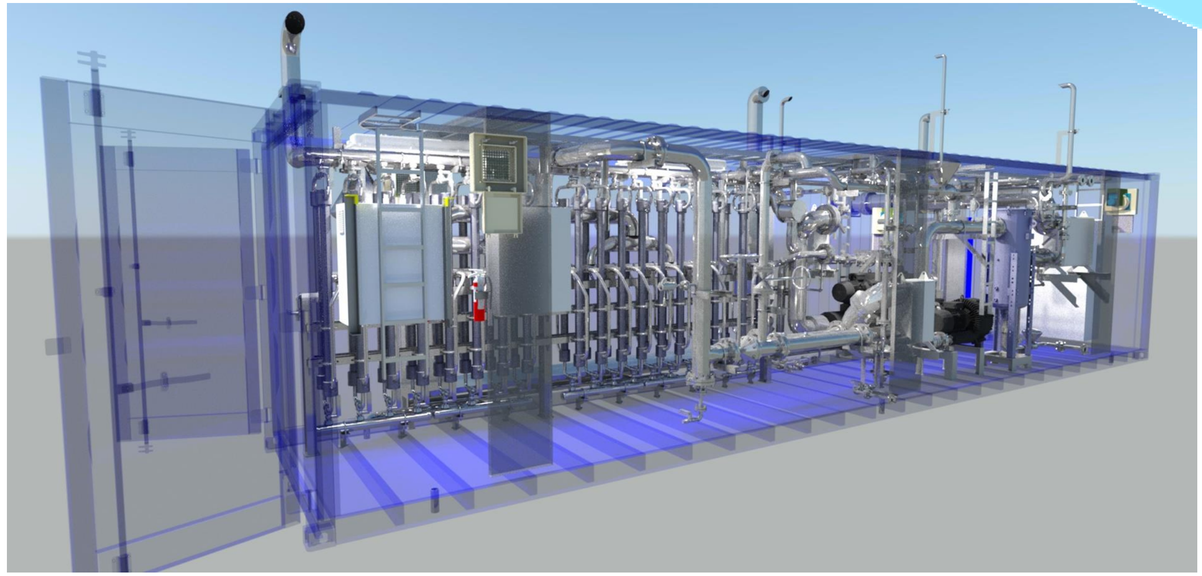
Profitably unlocking carbon capture across wide CO2 concentration ranges

- Aqualung accelerates decarbonisation and mitigates carbon costs across value chains by offering a safe, absorbent-free, and highly compact carbon capture system. The Aqualung unit will unlock CO2 that would otherwise be uneconomic to capture



- The core membrane technology is the culmination of over 20 years of research from Norwegian University of Science and Technology (“NTNU”), a world-leading technical research institution, that has revolutionised membrane technology
- Aqualung’s membrane has demonstrated, both at lab and pilot scale, superior properties with regards to permeability, selectivity, and safety with potential for superior capture economics
- Aqualung is in the process of providing proof of commercial concept via pilot units across numerous assets with varying CO2 concentration levels from 2% to 30% as well as DAC

No absorbents

Highly efficient

Lower CAPEX & OPEX

Modular & scalable

Compact & light

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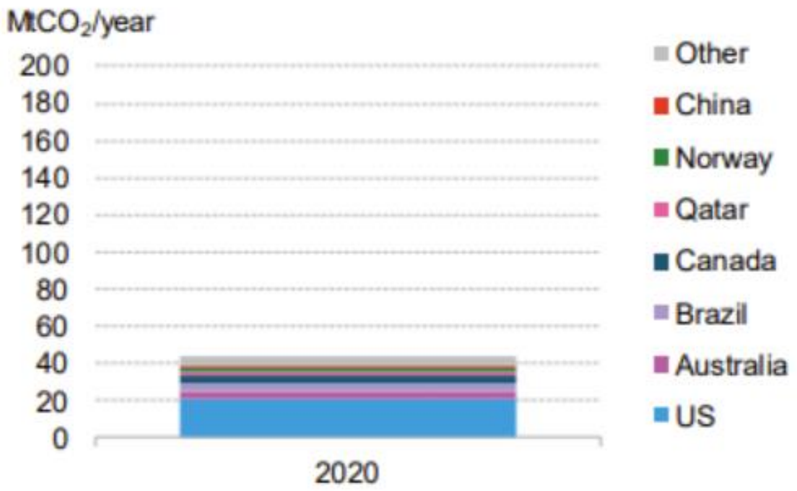
Carbon market overview

- The carbon capture market has the potential to be one of the largest markets in the world

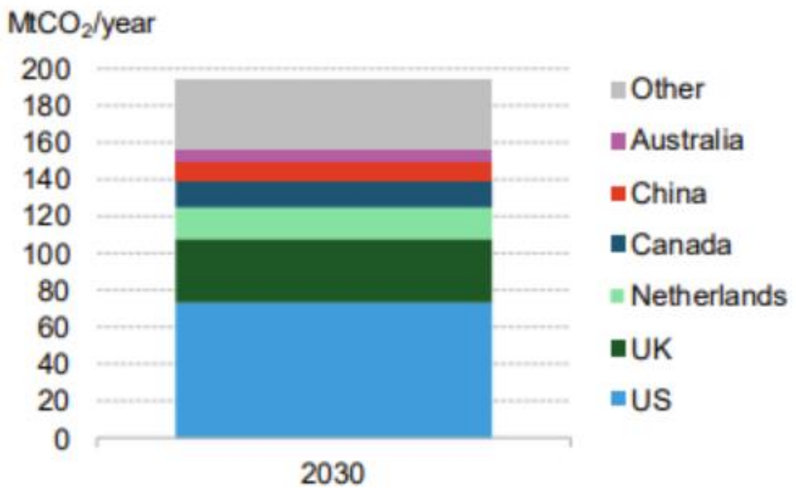
US emitted 4.5bn tons while EU emitted 1bn… at $80/t that is a $435tn market

Capture capacity market share by country, historical, 2020



Source: BloombergNEF

Capture capacity market share by country, announced, 2030



Source: BloombergNEF

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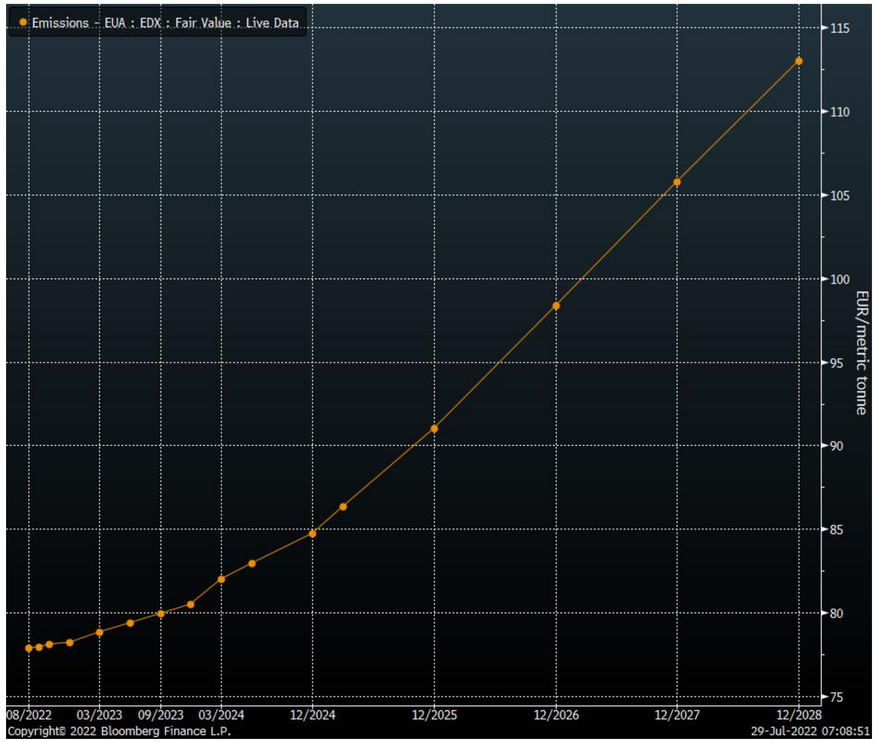
Carbon market update

US carbon markets

- 45Q tax credit was previously around $50/t for sequestration projects but the recent Inflation Reduction Act takes the price to $85 for geologic sequestration and $60 for utilization.
- Investment tax credit is a material game changer for financing and costs of our carbon capture solution in the US.
- Voluntary credit markets are currently trading $20 which could be an addition to the 45q.

EU carbon markets



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Aqualung locations

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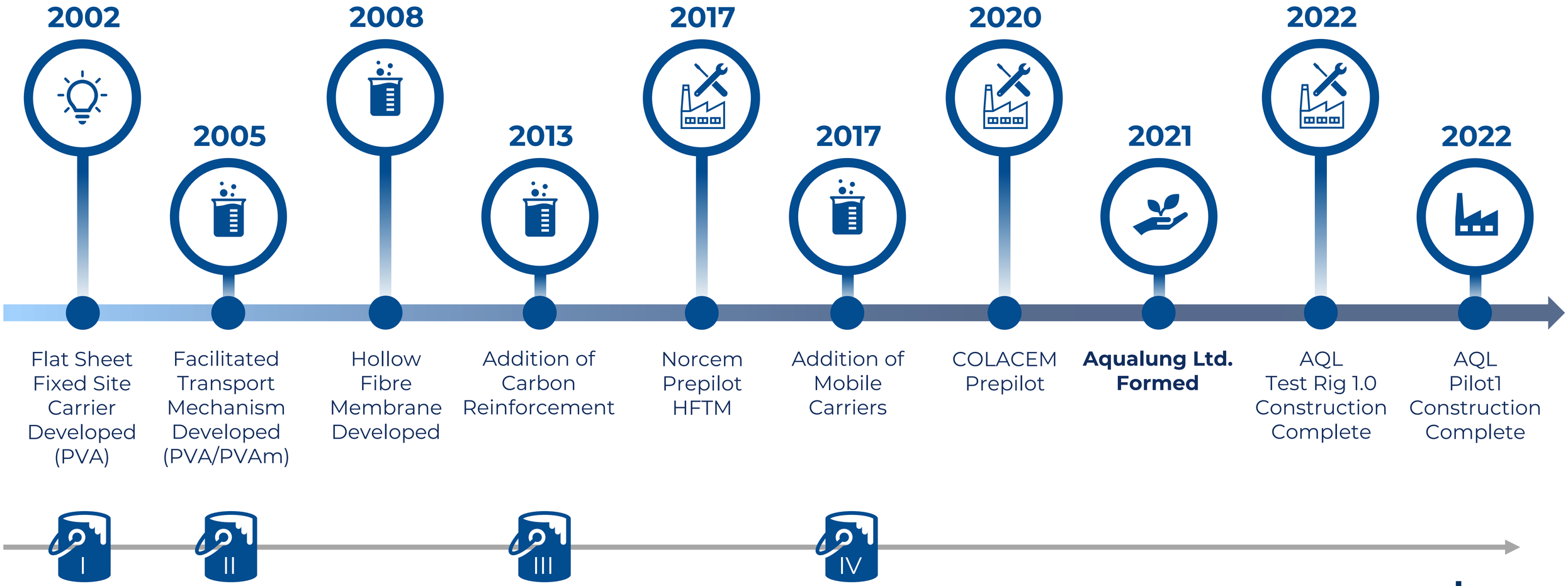
History

Following a global evaluation of the most promising lab scale carbon capture technologies, Aqualung was formed to commercialise the membrane CO2 separation technology developed over 20+ years at the Norwegian University of Science and Technology (NTNU).



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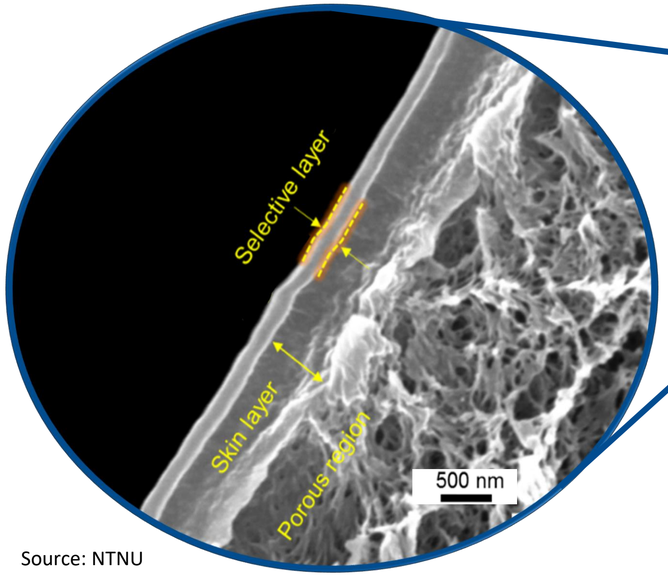
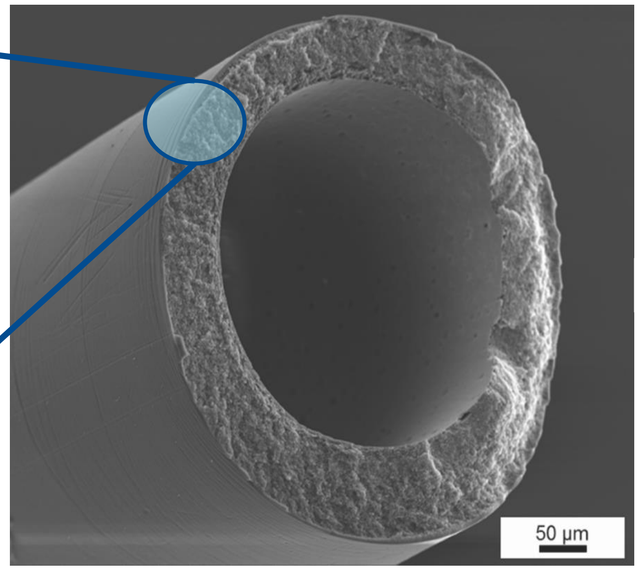
Aqualung Technology

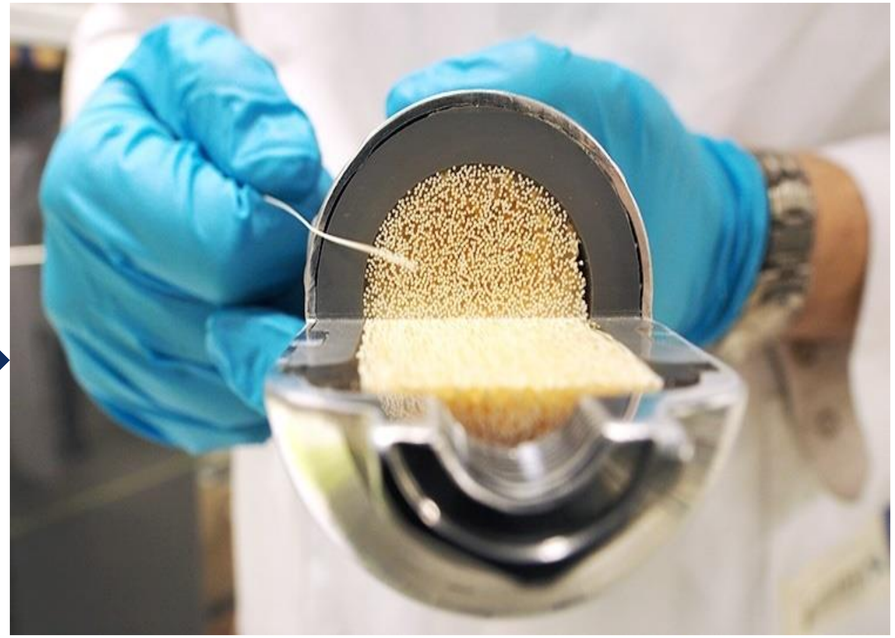
- Adapting commercially available hollow fibres to become highly CO2 selective and permeable

- The ultra fine selective layer is applied to spun hollow fibres, thousands of which are packaged into gas separating membrane modules. These Aqualung membranes are effectively a hyper-charged and highly selective micro filter.





Source: NTNU



Membrane Module

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The Aqualung solution explained

Aqualung uses membranes that can separate different substances, almost like a filter

1

Post combustion, the flue gas is diverted to the Aqualung membrane units

N_2 = 67%
CO_2 = 12%
H_2O= 11%
O_2= 9%
Acids= 1%

2 **Flue gas run through membrane**

3 **aqualung membrane**

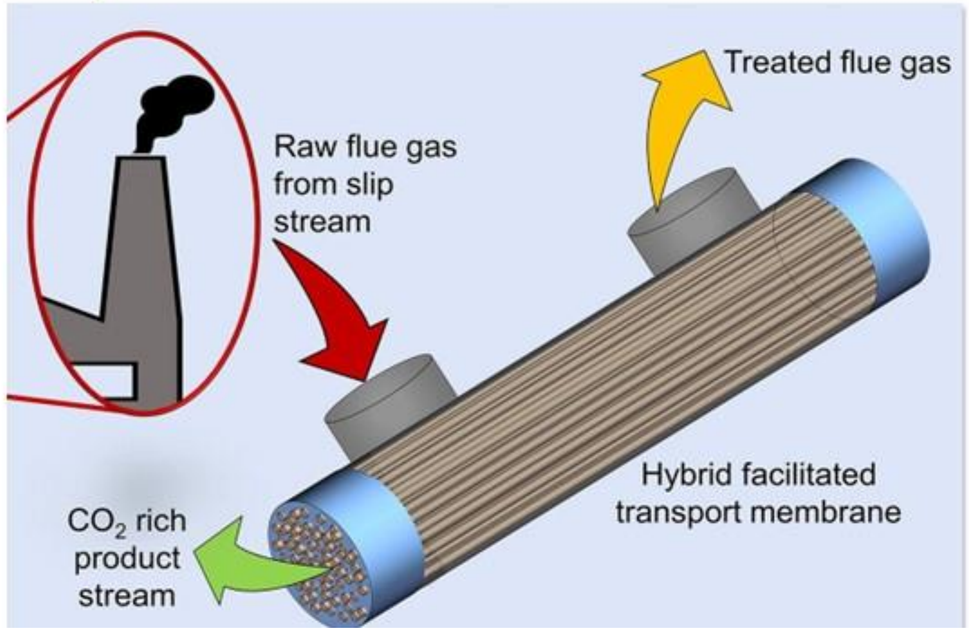
CO_2 is efficiently separated via a unique patented processes that utilises the water in the flue gas which results in low energy usage and small footprint

CO_2

H_2O

4

CO_2 purity can be optimised to transport via pipeline for EOR / sequestration or sent for liquid transportation



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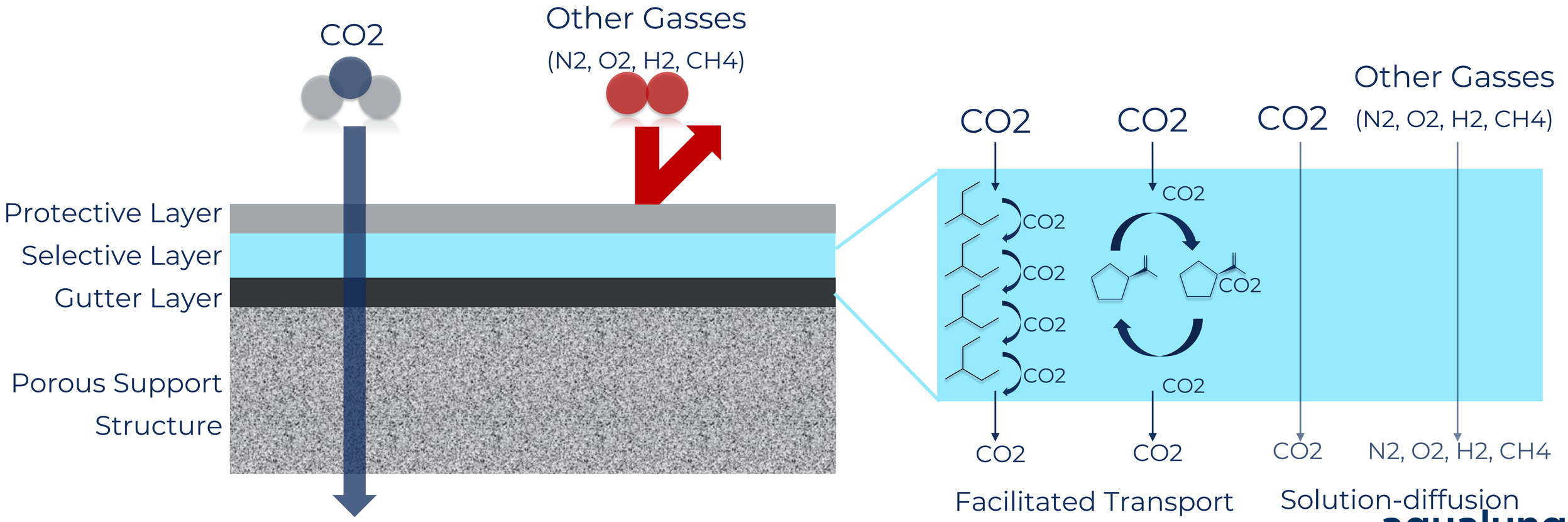
Aqualung Technology

A special combination of coatings are applied to a porous support structure. The patented Aqualung layer uses water vapour in the exhaust gas to selectively bind to CO2 molecules producing highly efficient transport across the membrane. This facilitated transportation mechanism utilises fixed site and mobile carriers to provide extremely high CO2 permeance and boost CO2 selectivity beyond what can be achieved by standard solution-diffusion membranes.



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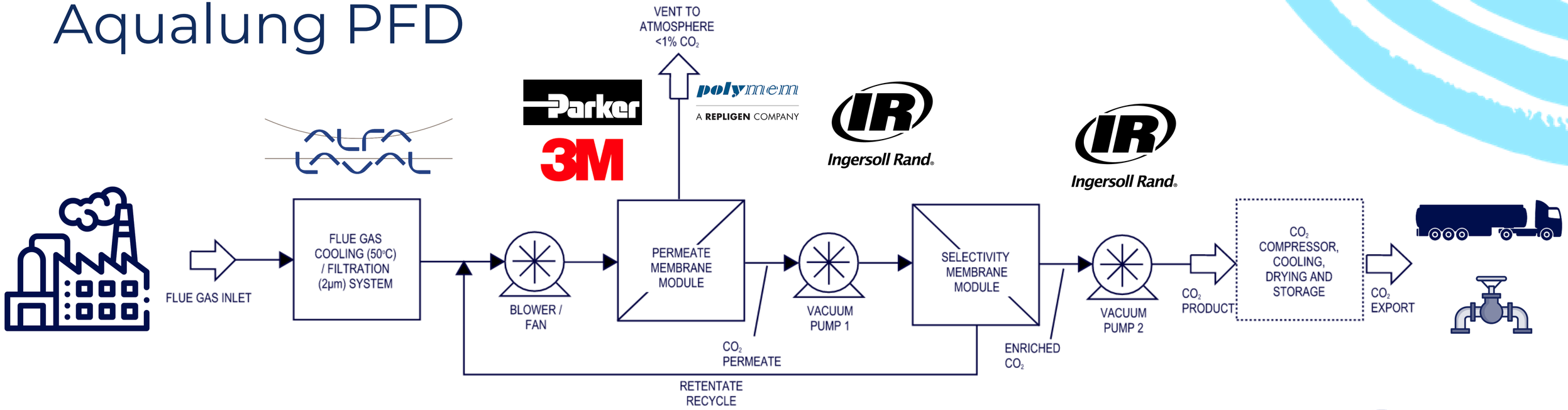
Aqualung PFD



A typical 2 stage system is shown. The first stage is significantly larger than the second stage and impacts the overall CO2 recovery. The second stage is used to increase the CO2 purity, higher target purities requiring higher recycle flow.

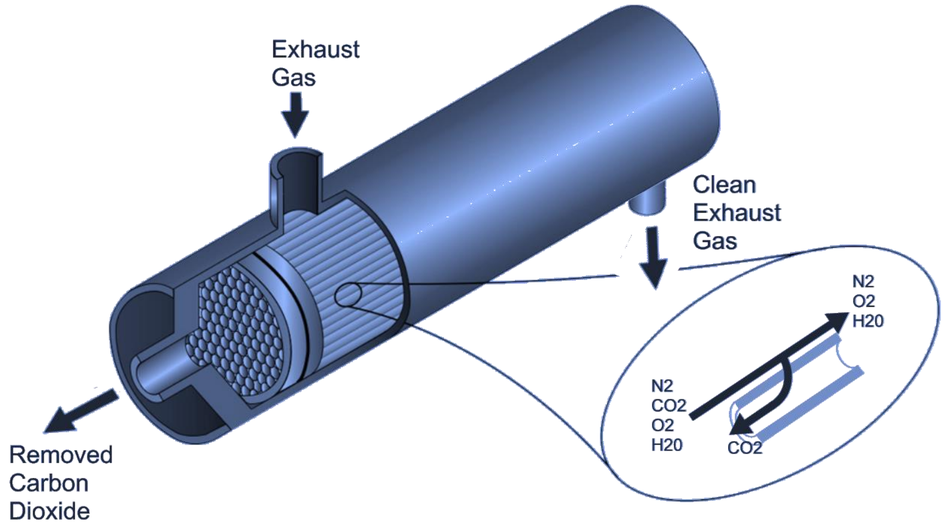
Pre-treatment may be required for particulate removal / cooling.

A blower is used to draw the exhaust stream into the system.

Vacuum pumps are used to provide the driving force across both membrane stages.

Membrane stages consist of multiple membrane modules operating in parallel.

CO2 purity can be optimised for transport via pipeline for EOR / sequestration / utilisation or sent for liquid transportation.



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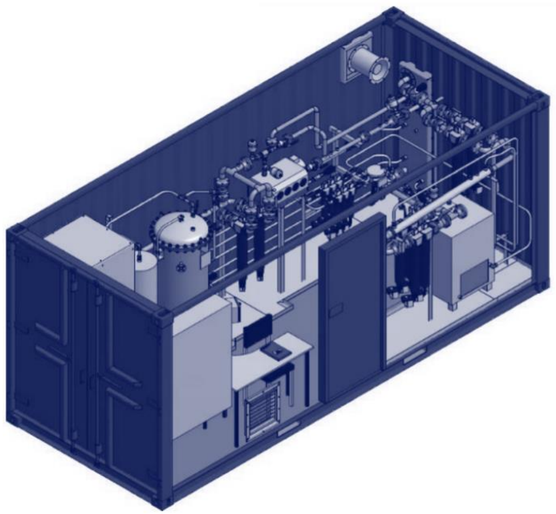
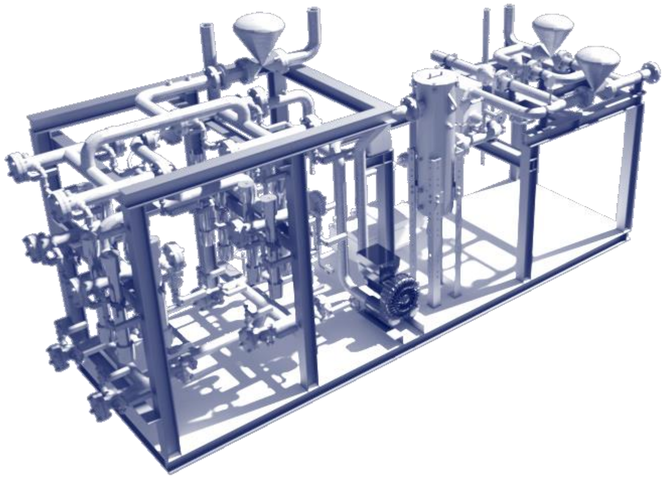
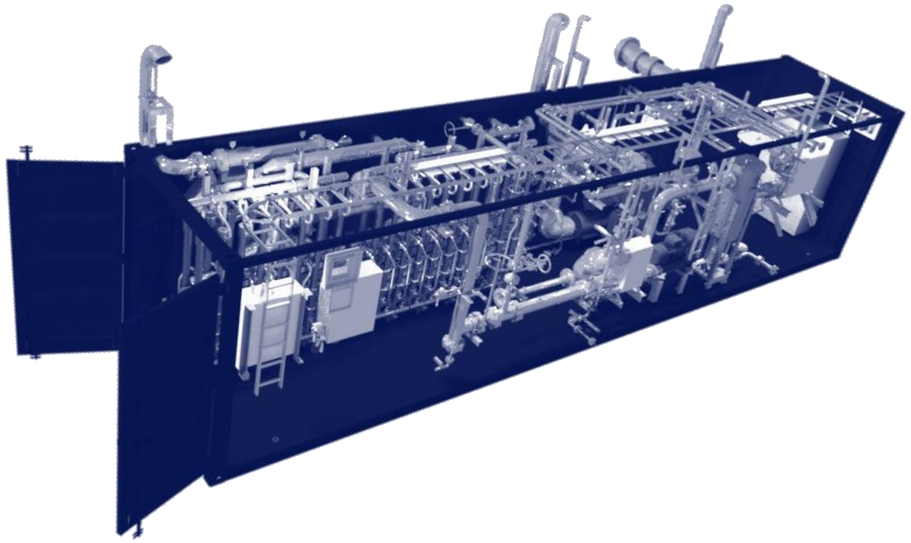
Technology Scale Up

	Lab Scale	Pre-pilot (gen3)	Pre-pilot (gen4)	Test Rig	Pilot1	Pilot2	Industrial1
Year	2006 - Present	2017	2020	2022	2023	2023	2024
Location	NTNU	Norway	Italy	UK	USA	Sweden	US
Emitter	Lab	Cement Plant	Cement Plant	Generator	Gas Boiler	Lime Kiln	Turbine
Module Size	10cm^2	4m^2	200cm^2	2-8m^2	8m^2	20-100m^2	50-200m^2
Total Area	10cm^2	15m^2	200cm^2	20m^2	200m^2	1400m^2	8400m^2
Carbon Capture				60tpa	300tpa	4ktpa	30-50ktpa







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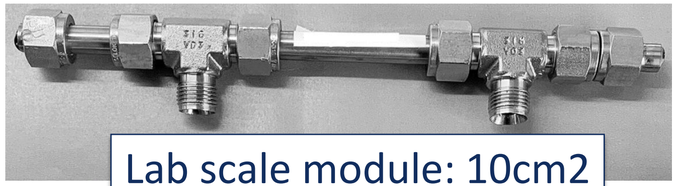
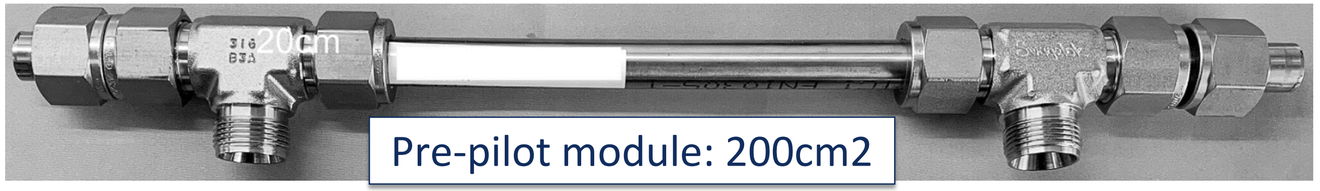
Previous technology Scale Up

The combination of commercial and bespoke modules (developed specifically for CO2 separation by Aqualung and their technical partners) is key to optimising and scaling up the technology; unlocking deployment onto larger emission sources.

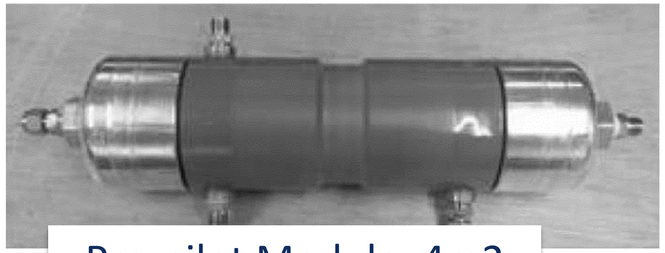


Lab scale module: 10cm2



Pre-pilot module: 200cm2

Test Rig Module: 2m2



Pre-pilot Module: 4m2

Pilot1 Module: 8m2

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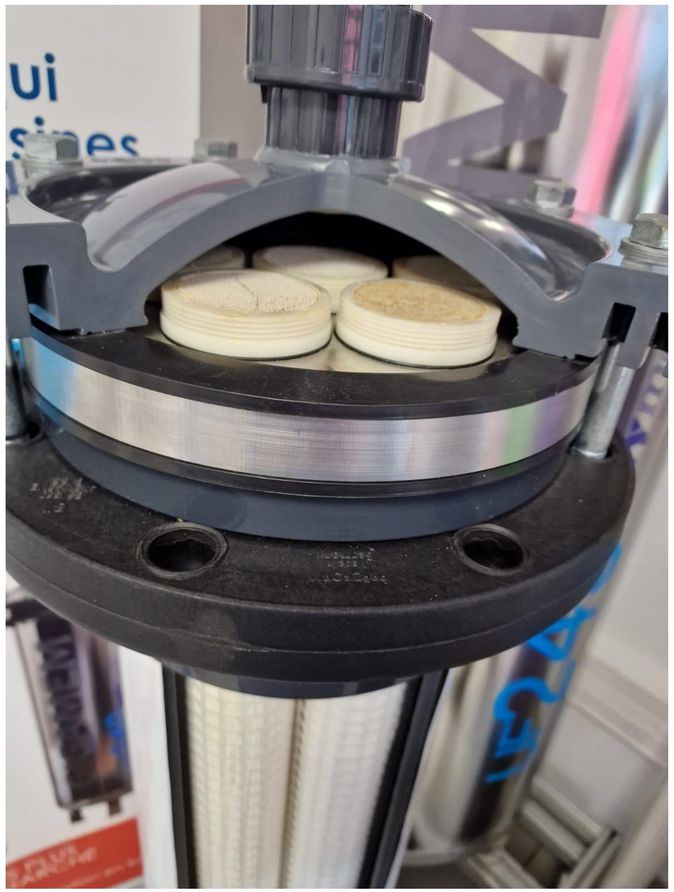
Gen2 membranes under development

The next step for Aqualung is to coat and produce a 700m2 membrane



Module: 700 – 1,000m2

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Ongoing Projects

Standard Lithium Pilot:

- 90% recovery (initial ~300tpa scale up to >3k) from gas fired boiler at 2-3% CO2 concentration
- Operated in Arkansas with Standard Lithium

SigmaRoc Pilot:

- 90% CO2 recovery from lime kiln emission in Sweden at 16-20% CO2 concentration
- Customer is keen to proceed to an order of full industrial scale plant and targets up to 260ktpa CO2 by 2024 (multiple trains of 30ktpa)

Test Rig 2.0:

- Test membrane performance with diesel / LPG engine
- Single stage multi variable testing
- Delivery slated for Q3 2023

Andritz mobile unit:

- CO2 capture rate 170-240 TPA – multiple cases defined such as pulp & paper, waste-to-energy
- Delivery slated for Q4 2023

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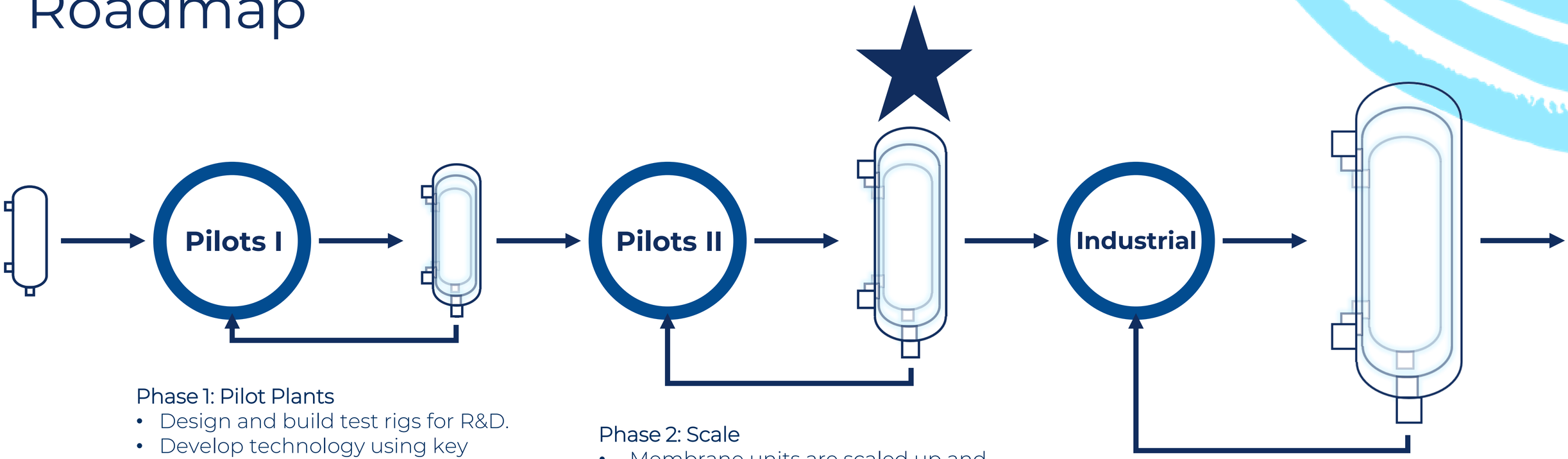
Roadmap



Phase 1: Pilot Plants

- Design and build test rigs for R&D.
- Develop technology using key technical partnerships.
- Design and build containerised pilot plants and install on a variety of emission sources across various industries.

Phase 2: Scale

- Membrane units are scaled up and customised.
- Larger membranes are retrofit onto existing pilots for benchmarking.
- Larger pilot plants delivered.
- Feasibility/FEED for industrial scale plants begins.
- Develop partnerships for storage and transportation to unlock full CCUS.

Phase 3: Commercialise

- Execution of multiple industrial scale plants using EPCs.
- Working with the full value chain in the CCUS industry.

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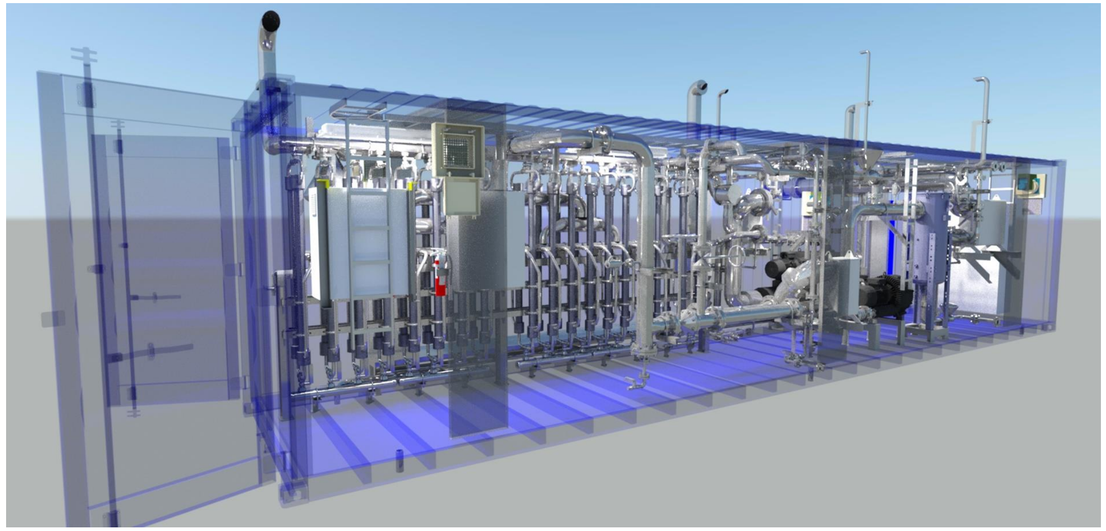
Roll-out plan for gen 1 design CCU

With a product in hand, we can begin to immediately roll-out at 10-50k TPA.

The cement industry alone emitted 41m tons in 2020

Standard Lithium Pilot + Zeton + Additional consultant review will give us line of sight to a commercial (12,500-30,000 TPA) unit
Allows us to bring in cash flow which will finance our continued upscaling for larger projects

Utilization market - through numerous discussions with customers we have uncovered a material interest for small scale units that are indifferent to high purity



CO2 utilization-markets:

- Lithium
- Greenhouses
- Food-preservation
- Minerals production
- CO2-to-chemicals
- Lime
- Cement
- Roofing / building material

Utilization gets us access to 45Q at $60/t plus voluntary credit of $20/t
Equally important is it gets our capture / storage partnership on site first producing cash flow for the emitter as larger projects develop

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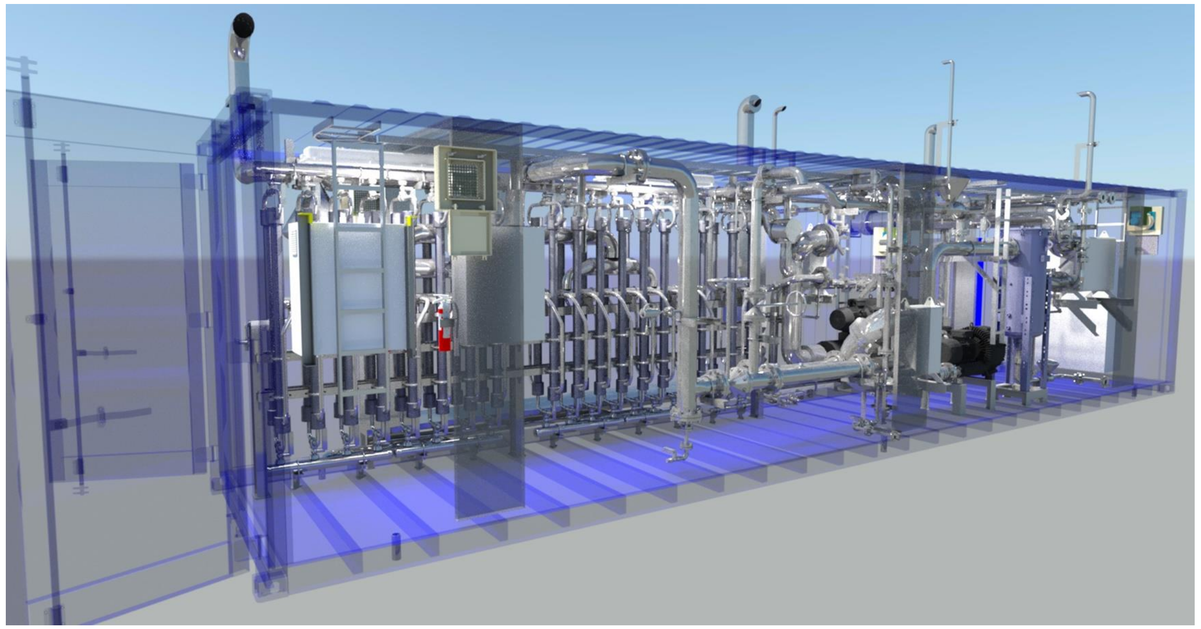
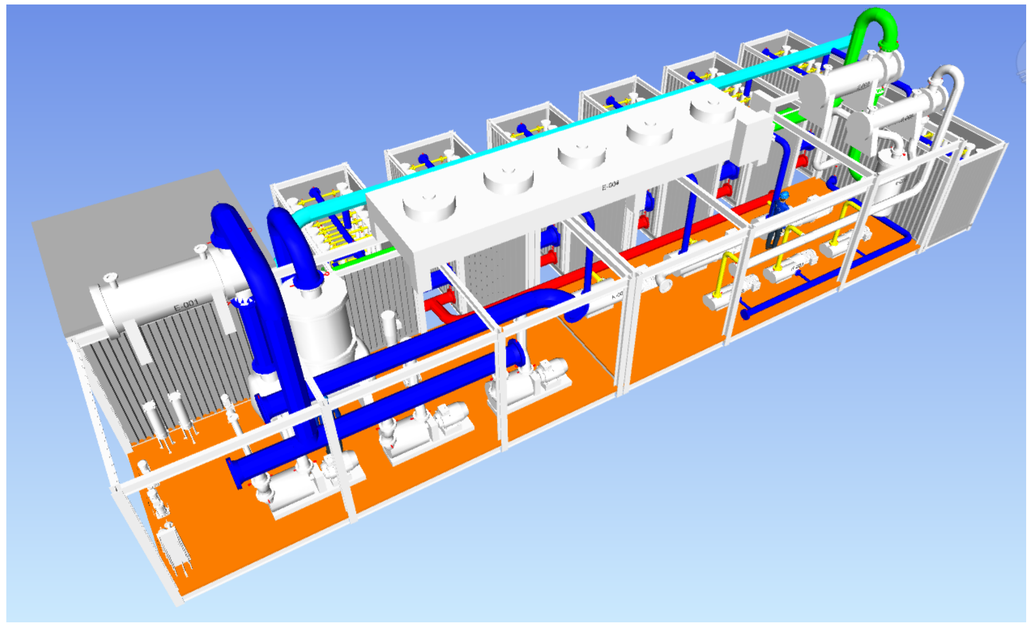
Design packages for commercial units

- The pilot design package (left image) will be used for projects 12,500-30,000 and will be a configuration of 40-foot TEU containers
- For larger commercial projects Aqualung will use the ongoing concept design package for a 100,000 TPA unit (right image)





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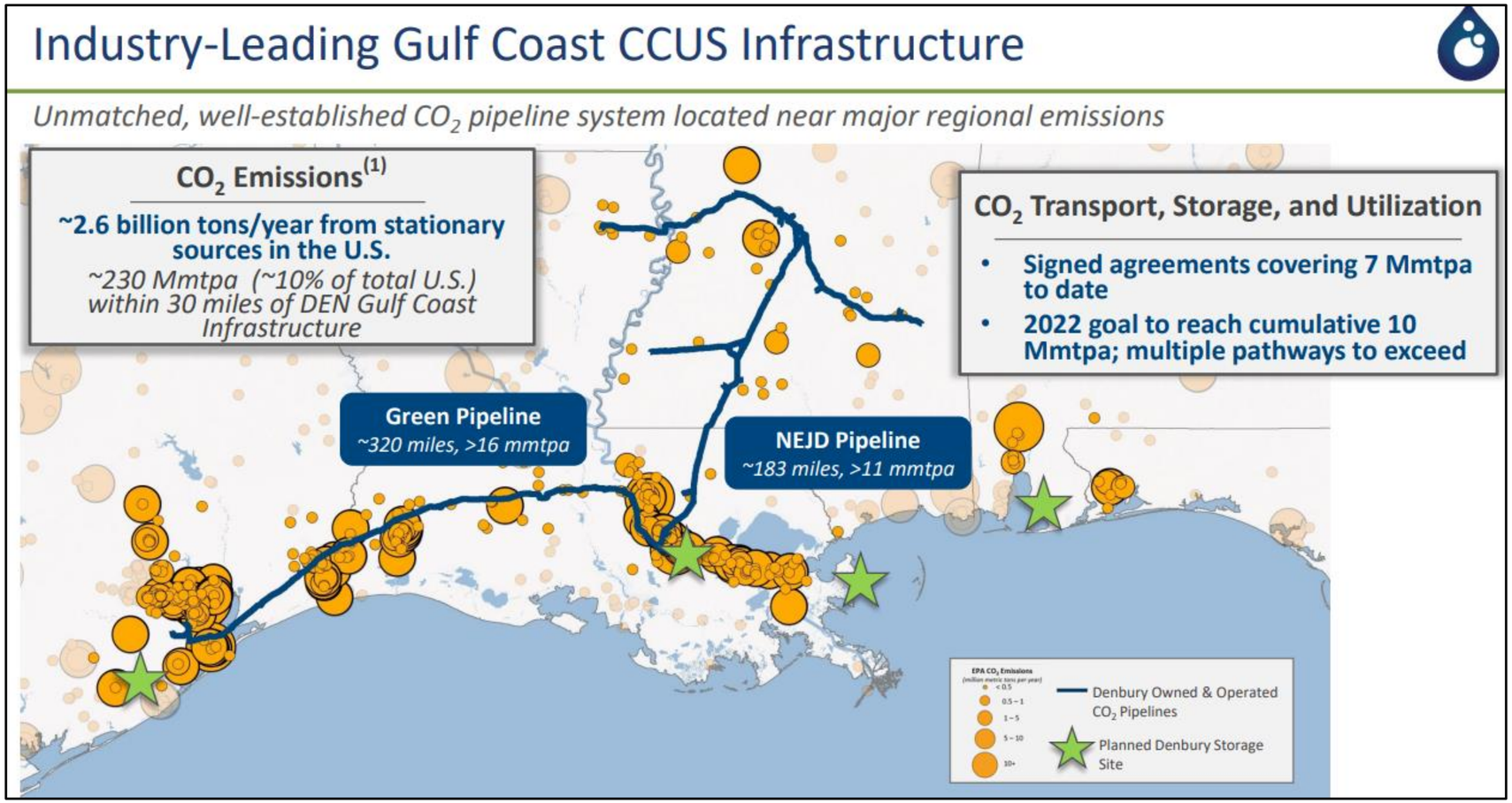
Sequestration partnership with Denbury



There are over 12m tons of CO2 w/in 1 mile

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Roll-out plan for gen 2

Large scale membrane units will unlock industrial CCS projects in 2024

Product-basis:

- 2nd gen design (ZETON or Andritz)
- Large-scale bespoke modules (100+ m2)

Markets:

- Petchem refinery
- Chemical production
- Lime
- Cement
- Shipping
- Offshore
- Minerals extraction and refining
- Oil & gas production onshore

Market characteristics:

- 100,000 – 1,000,000 TPA
- High purity requirements (97%+)
- Pricing depends on economic competitiveness of full CO2-chain.
- Complex market and competitive dynamics.

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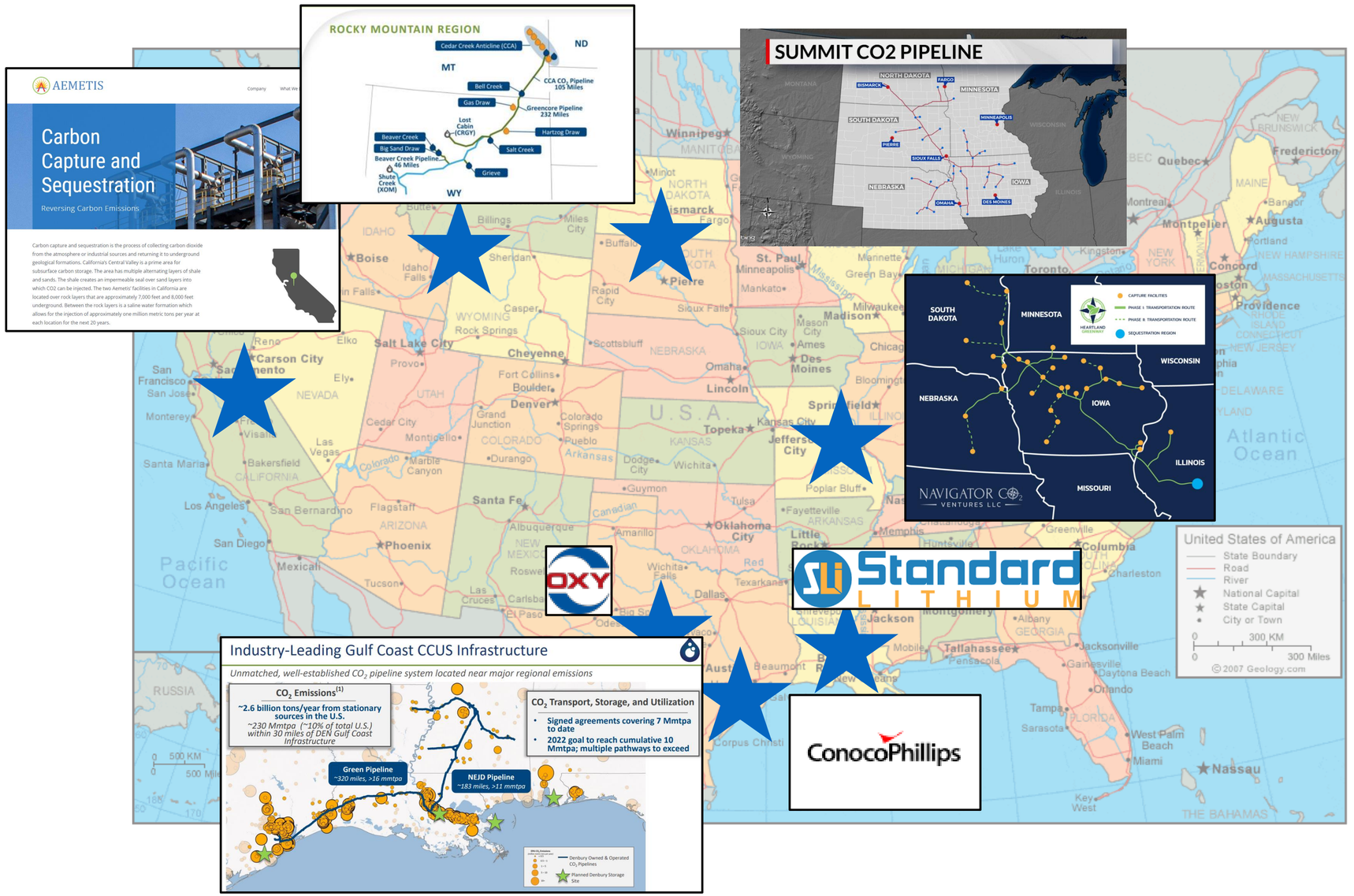
US sequestration partnerships



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Target markets

Previous pilot results drive attractive economics which can be further optimized

Scenario analysis (CO2 concentration level /size of unit tpa)

	Cement (19% CO2 / 223k TPA)	Coal (13% CO2 / 310k TPA)	Ship (5% CO2 / 23k TPA)	Gas turbine (4% CO2 / 49k TPA)	FLNG (4% CO2 / 263k TPA)	Waste to energy (9% CO2 / 54k TPA)
Total CAPEX fully installed $/t	55	60	170	115	142	60
Total OPEX $/t	24	20	30	32	31	25

As we scale up manufacturing / coating capacity we can start to target larger projects that will drive material volume

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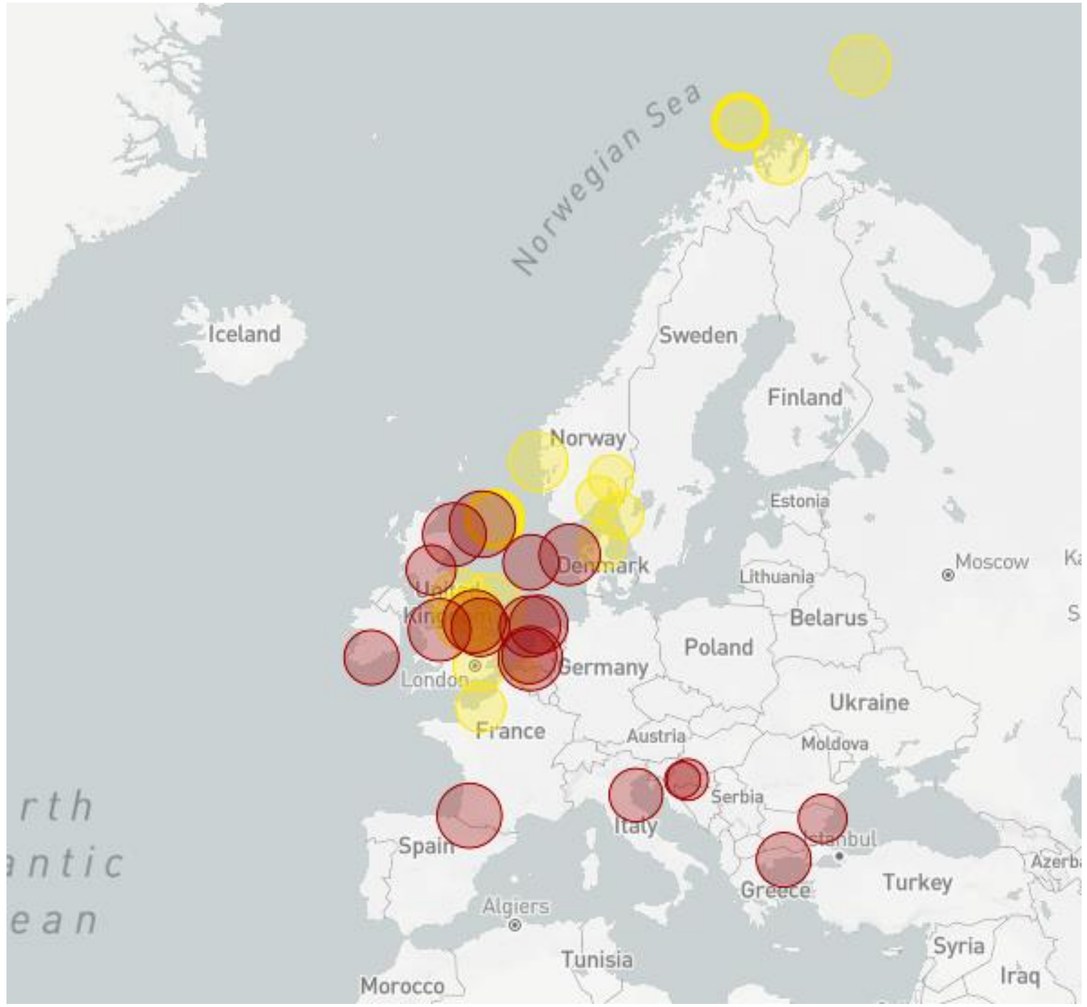
EU sequestration partnerships

- Northern Lights is the most advanced but numerous projects are starting to begin development / planning
- Aqualung has been in discussion with numerous sequestration partners including Equinor, Shell, Storegga
- Reducing CO2 liquefaction costs is going to be key to unlock majority of these markets from a sequestration perspective but is where CO2 utilization makes sense.



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Unique Membrane Solution

Low complexity, environmentally friendly

Highly efficient

Highly favourable energy balance

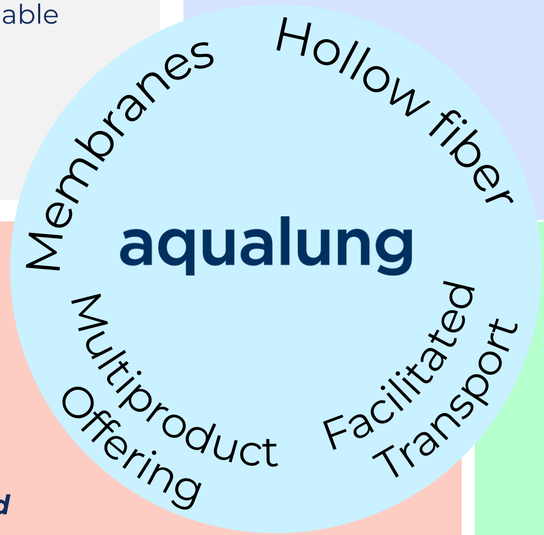
Fully scalable

Highly compact

High packing density
Low footprint of the process and high gas volumes processed by m^2 and m^3 of membranes

Easy scale-up
Unlike Plate&Frame and Spiral wound modules, potential for cost reduction on HF modules is immense due to housing alternates and easier scale up properties → lower CAPEX

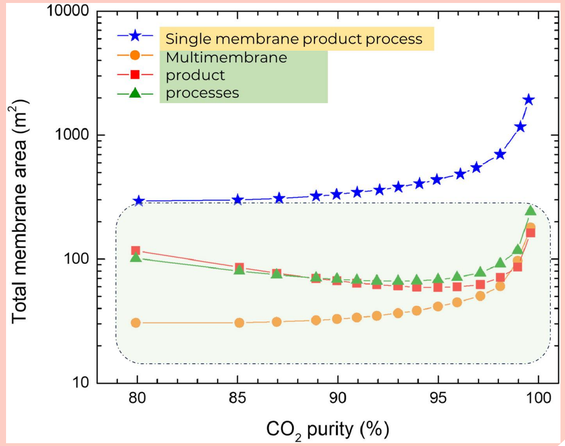
Low complexity
Simpler flow patterns suitable for low pressure and driving force operations. Low pressure drop also translates to OPEX savings



Higher flexibility
Single product processes have flexibility limitations

High selectivity → Not always required

A recipe of membranes
AQL's patented technology covers a recipe of membranes that yield different performances based on the contents and coating parameters



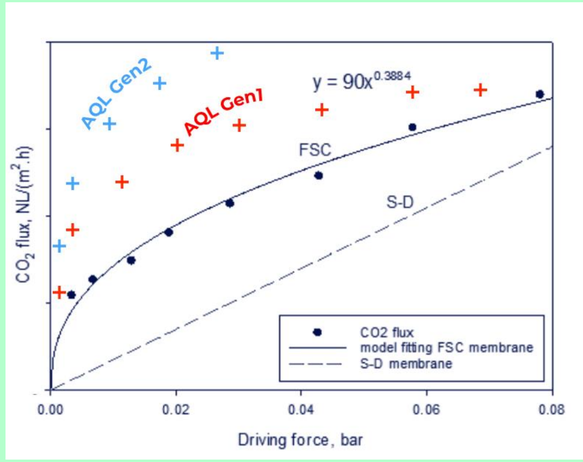
Low driving force operation
Post combustion CO_2 capture is a low driving force separation. Membranes in the market and those being researched have limitation in terms of transport mechanisms, or scalability or requirement of pressurization or feed gas

Simpler processes
Two-stage systems or systems with recycle will yield necessary capture rate

No boiler retrofits and high-pressure compressors → True tail-end process

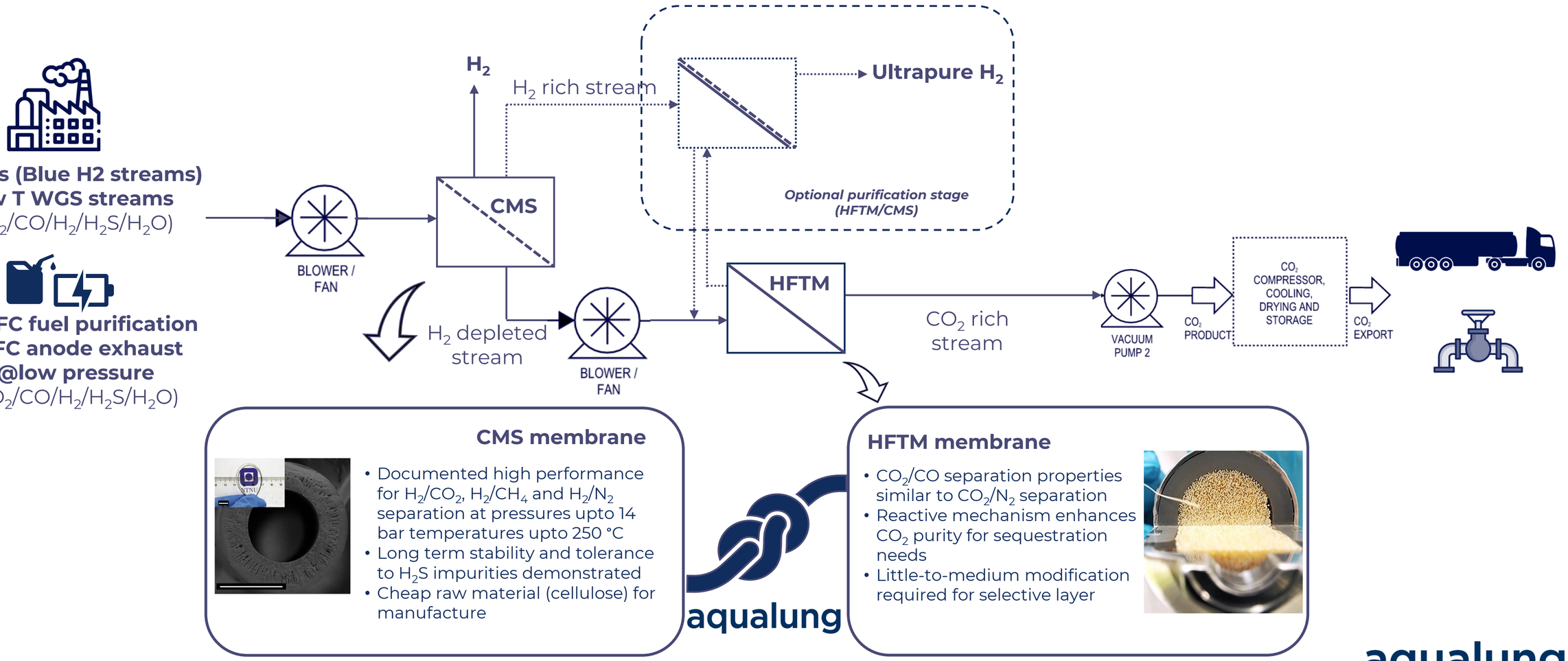
Less pretreatment
FT membranes tolerate and permeate acidic gases like SOx due to their swollen state. AQL processes need less pretreatment

Tuneable facilitated transport effect
Reactive sites tuneable with mobile carriers and polymer background matrix → Higher non-linearity with CO_2 flux and driving force
→ High performance – low CAPEX
→ Low pressure operation – low OPEX



CMS/HFTM – unlocking CO_2 capture with H2 separation membranes

High level CMS/HFTM process for CO_2 capture for H_2 generation/use



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