

Compact and high throughput modular unit for carbon capture on ships

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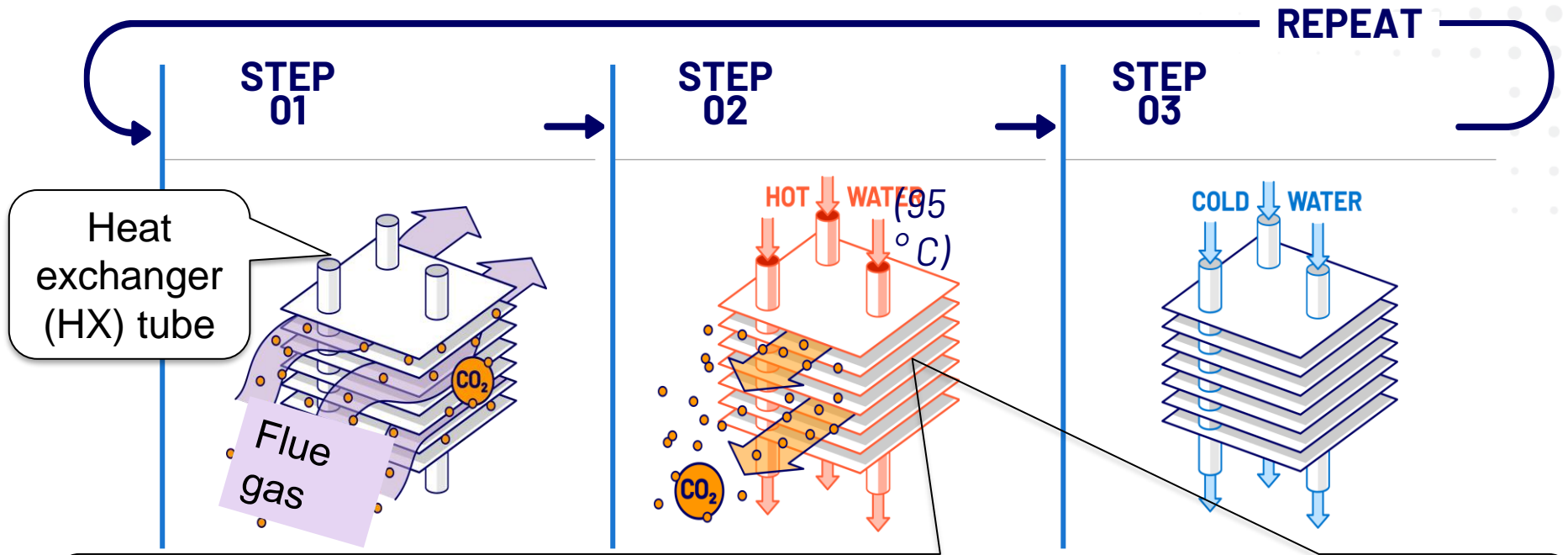
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The phase I objective

Develop basic process design and conduct feasibility study of the adsorption and heat exchange (AHX) capture unit for CO₂ capture on ships at flue gas exhaust rate of 700 kg/min with two CO₂ disposal methods:

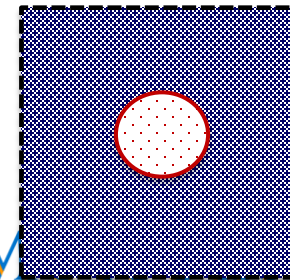
- Onboard storage of liquified CO₂
- Onboard electrochemical conversion of CO₂ back to oxygenated fuels.

Molecule Works' proprietary adsorption and heat exchange (AHX) contactor for low-cost CO₂ capture



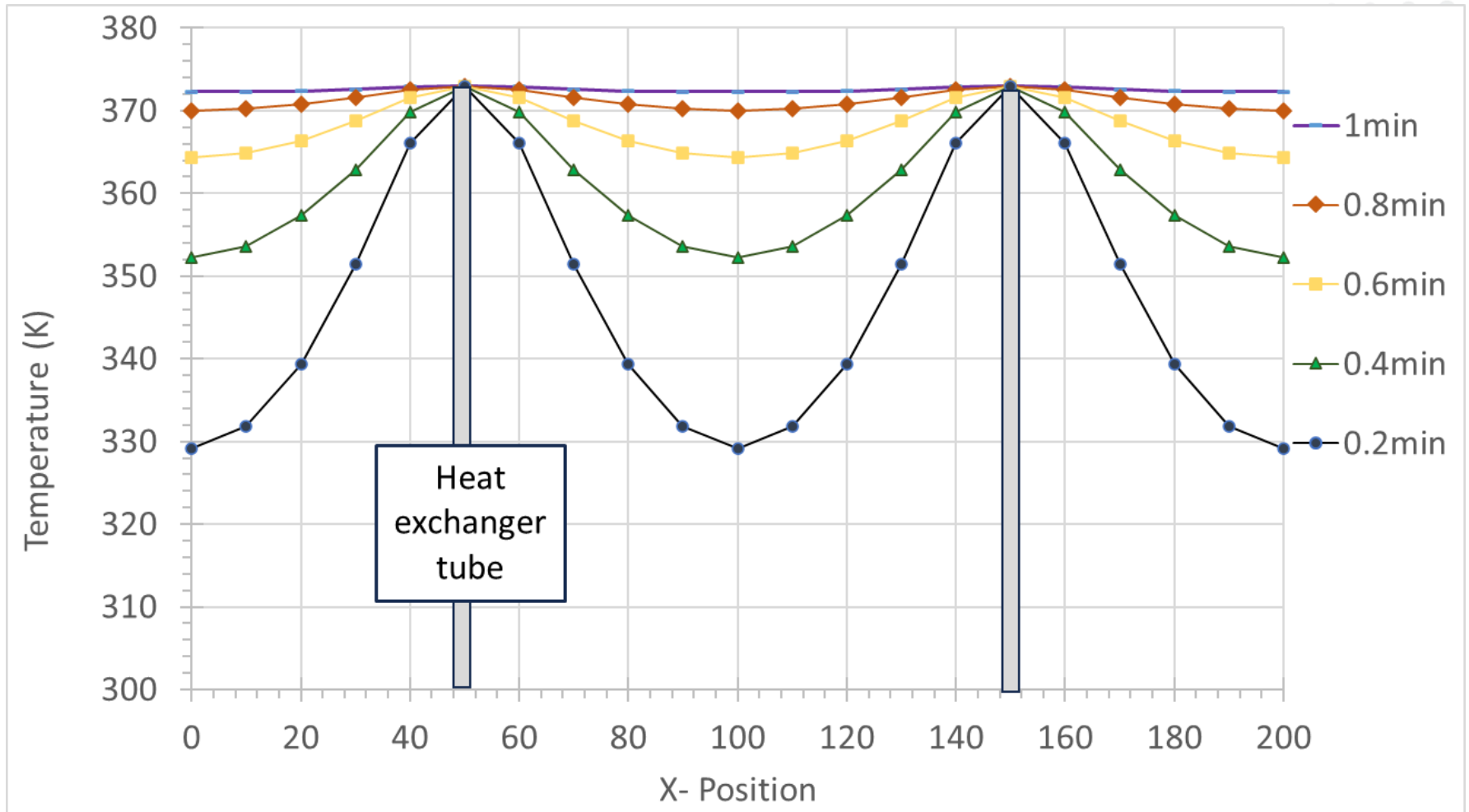
Adsorption and heat exchange (AHX) plate of **high adsorbent loading (g/cm²)** and **high thermal conductivity**

Scaleup by increasing number of unit AHX cells in 3 dimensions



AHX unit cell

Rapid heating of the AHX plate from 293 to 373K by hot thermal fluid in the heat exchange tube



Molecule Works' prototype units employing AHX contactor

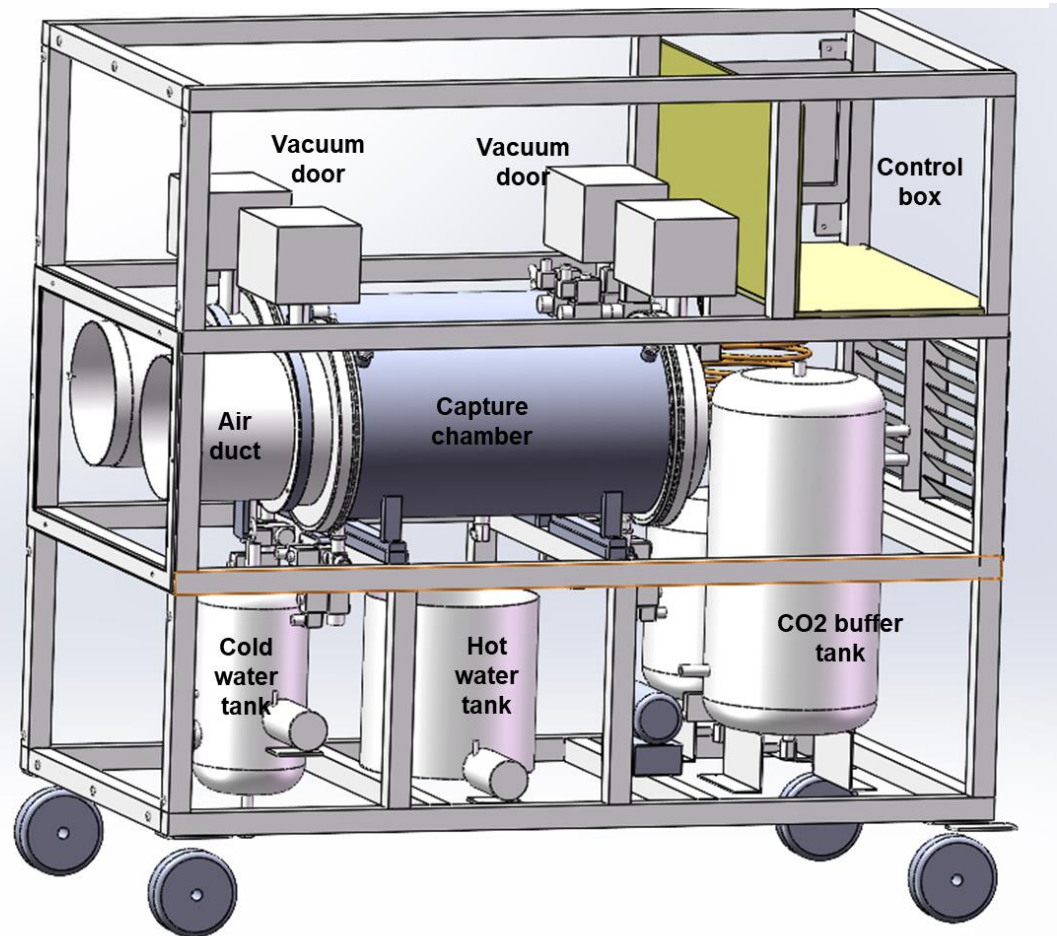
Single-vessel unit for screening of adsorbent performances (capacity, stability) and design parameters



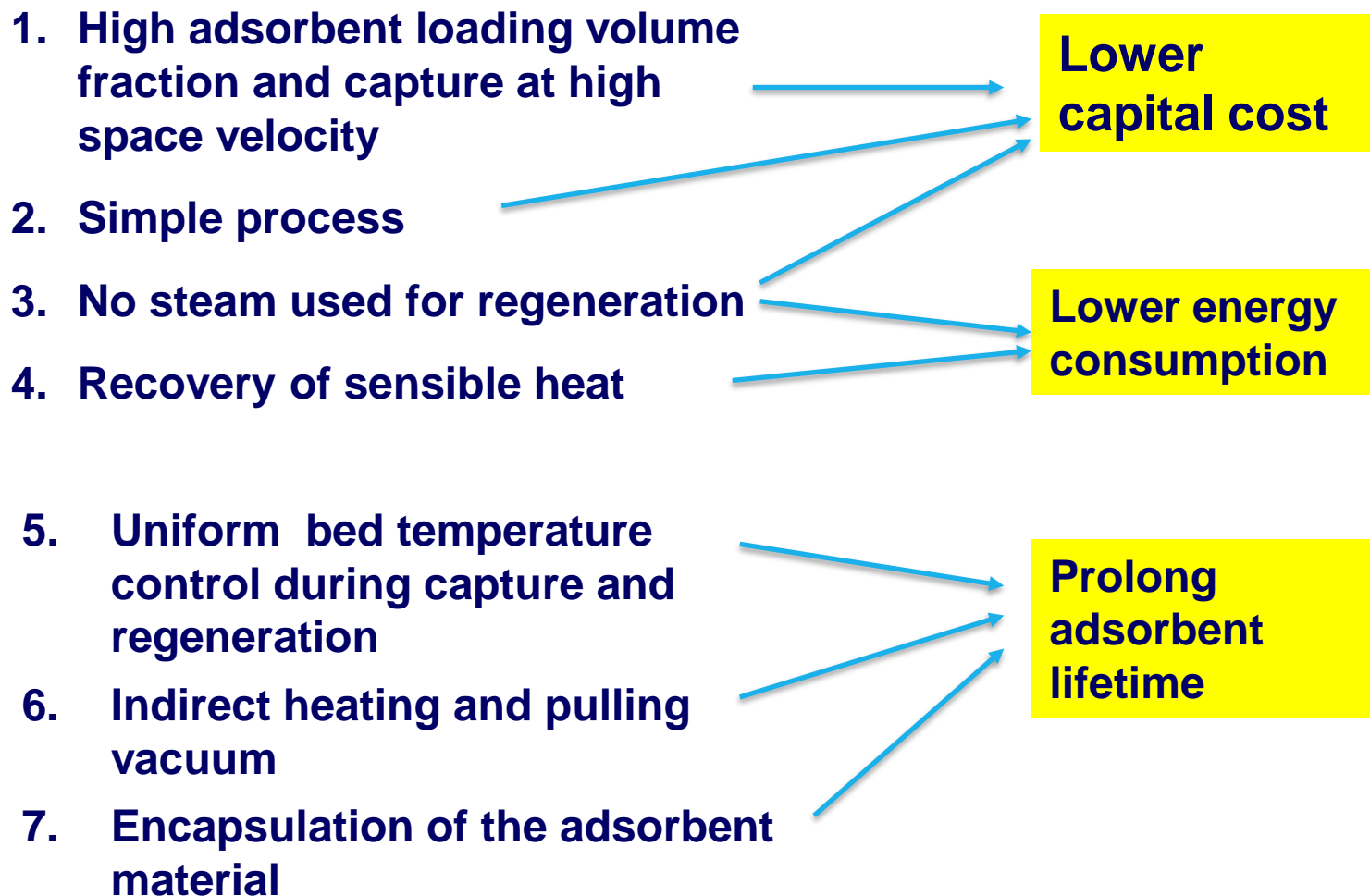
~3 m² gas/solid mass transfer area

Two-vessel prototype unit to simulate scaleup capture processes

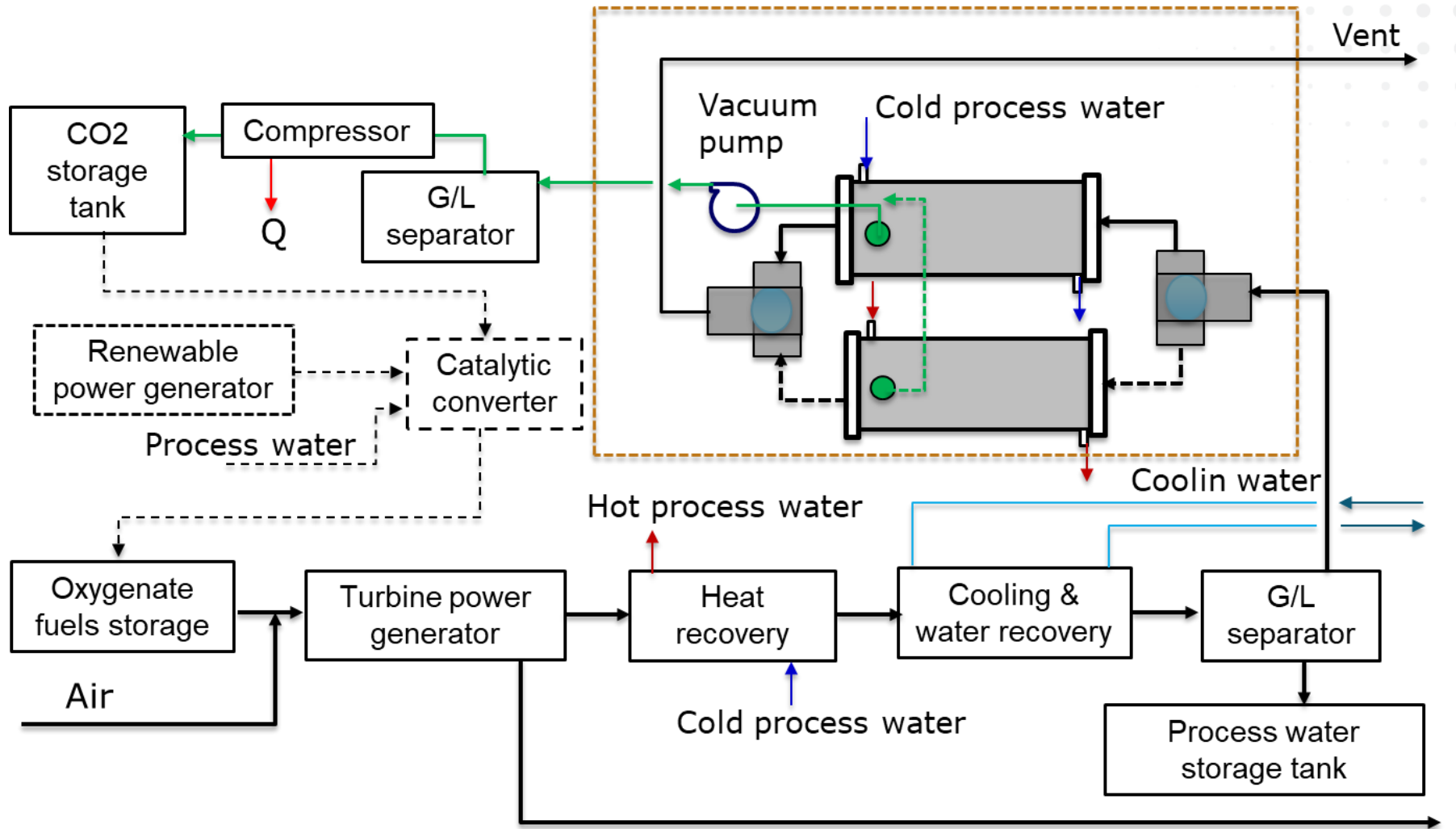
~8 m² gas/solid mass transfer area /vessel



Performance features of the AHX contactor addressing capital cost, energy consumption, adsorbent lifetime issues



Process flow diagram proposed for reduction of CO₂ emissions on ships



Expected outcomes of phase I work

- Overall material and energy balances
- Specifications and cost of major pieces of equipment
- Process designs and performance targets of the capture and/or conversion units to make the onboard capture process be a new potential opportunity for commercialization pursuit.