

# 8 Rivers

Company Overview and Zero-emissions Industrial Heat

8 RIVERS

# 8 Rivers Anchors the Circular Economy with Clean Fuels and Energy

We are moving towards a circular economy, in which industrial byproducts are captured, recycled and monetized rather than discarded



# 8 Rivers Technology & Project Experience

Innovation | Commercialization | Deployment - *Hands-On Execution Experience in Technology and Project Development*

**14 Years**

In Decarbonization

**>400**

Patents Granted

**>\$1B**

Invested into 8 Rivers Platform

**>\$75M**

Grants Awarded

## TECHNOLOGY DEVELOPMENT

8 Rivers has a robust technology portfolio to meet a diverse set of low-carbon energy challenges.

## PROJECT DEVELOPMENT

The 8RC project development engine specializes in marquee deployment of low-carbon projects.

## SERVICES

8 Rivers is a net-zero services and solutions provider aiding project conceptualization and engineering design.





## **Updates since 2022 IPER**

# SK Group, 8 Rivers form zero-emissions joint venture

By Nina Chestney



LONDON, March 8 (Reuters) - U.S. clean technology firm 8 Rivers Capital has secured \$100 million in investment from South Korea's SK Group ([034730.KS](#)) and formed a joint venture to deploy zero-emissions projects in the Asia-Pacific region, the company said on Tuesday.

# SK Group Invests \$100M into 8 Rivers

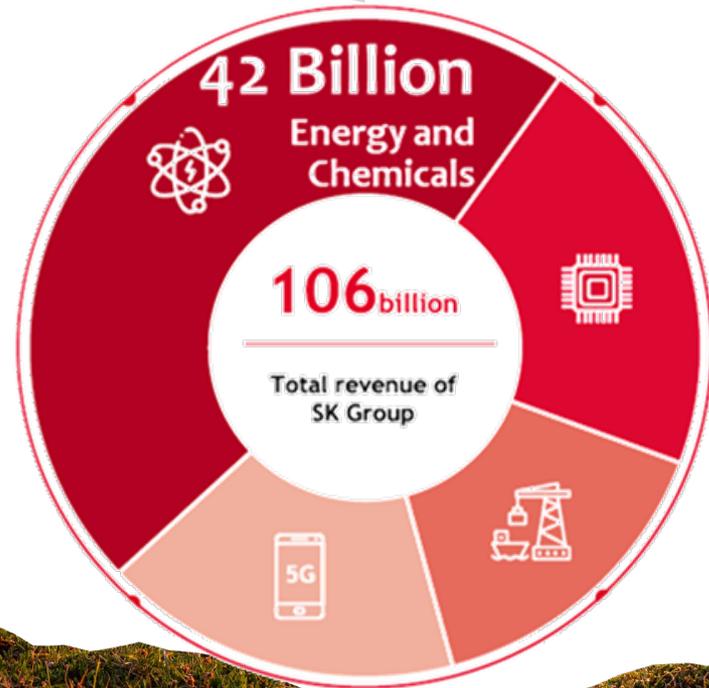
SK has pledged to **cut 200 million tons** of carbon emissions globally **by 2030**.

SK has announced a "complete shift in the central axis of business" and stated that it plans to move from a carbon business to a **green business**.

SK is expanding its global presence and employs over 81,000 people, including 16,000 people in some **260 global affiliates/branches worldwide**.

"All SK Group affiliates will achieve net zero carbon emissions **ahead of its 2050 goal**"

- SK inc. Chairman Chey Tae-won



# NETPOWER's first commercial unit

 Energy Intelligence

Energy Transition	Oil Markets	Gas and LNG	Risk	Competitive Intelligence	Energy Intelligence Premium
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## NET Power to Build Major Permian Plant for Oxy

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## \$1.459B

pro forma enterprise value of **Rice Acquisition Corp (RONI)** and should soon be publicly listed as **NET Power (NPWR)**, as the deal is expected to close in Q2 of 2023

\$535MM of cash to NET Power net of transaction fees (assuming no redemptions) consisting of \$347MM of cash in trust of which, \$235MM is comprised of:

- \$100MM from the Rice Family
- \$100MM from Occidental
- \$5MM from 8 Rivers
- \$5MM from Constellation
- \$25MM from other investors

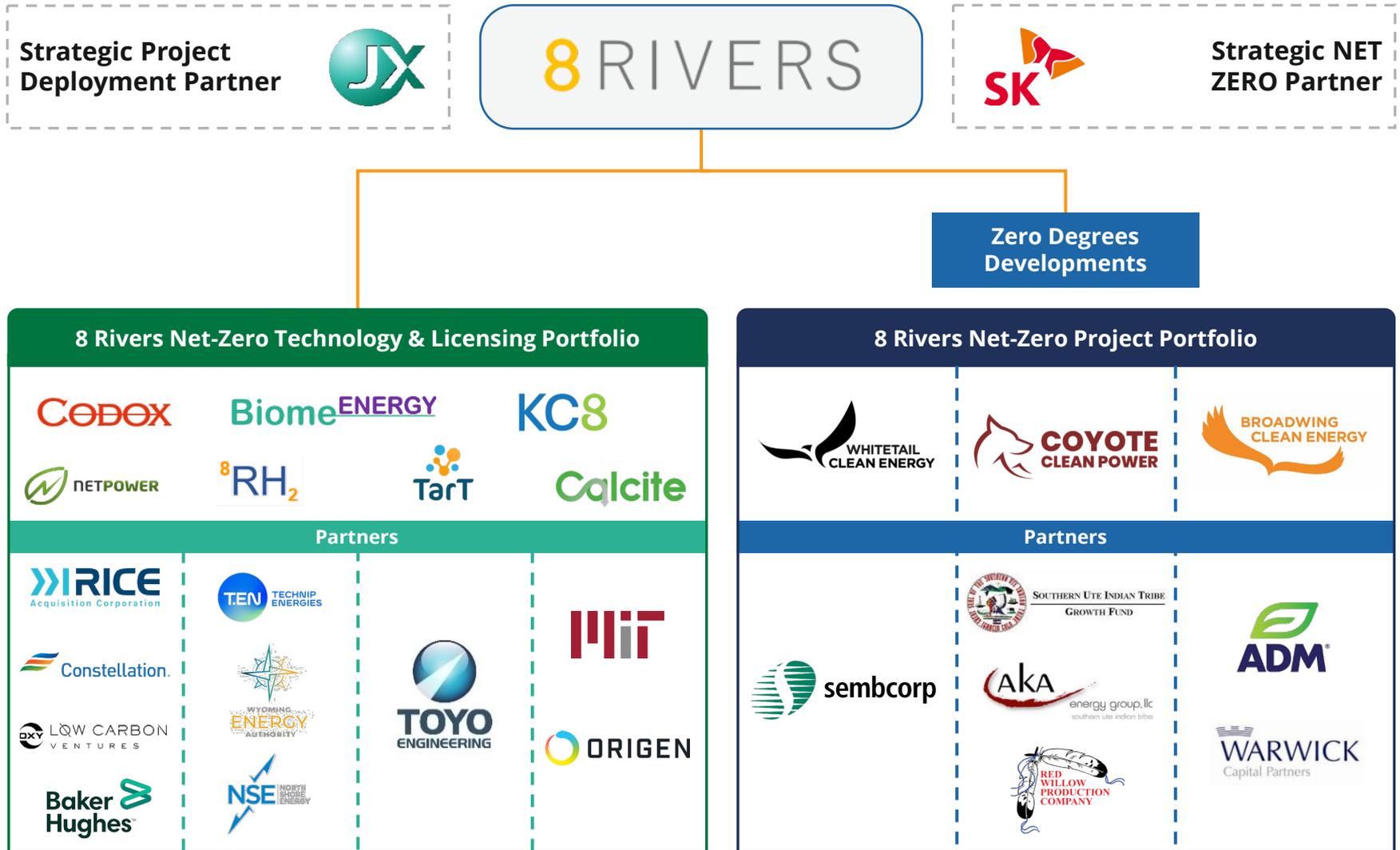
## NET Power on NYSE





## About 8 Rivers

# Map of 8 Rivers Technologies and Project Partners (not exhaustive)



# 8 Rivers' Unique Place in the Clean Fuels and Energy Market

8 Rivers offers the one of the strongest collections of ESG technologies touching multiple power, industrials, and chemicals processes

 	 	 	 	 
<p><b>Zero-Emissions Electricity</b></p> <p>Challenge solved: Emissions-heavy power generation from traditional energy sources</p>	<p><b>Zero-Emissions Hydrogen and Ammonia</b></p> <p>Challenge solved: Costly and emissions-heavy hydrogen and ammonia generation to meet growing global demand</p>	<p><b>H<sub>2</sub>S Sour Gas to Sweet Gas</b></p> <p>Challenge solved: Unlocking value trapped in uneconomic global sour gas reserves</p>	<p><b>Direct Air Capture of CO<sub>2</sub> (DAC)</b></p> <p>Challenge solved: Unprofitable existing CO<sub>2</sub> direct air capture methods</p>	<p><b>Post-Combustion Capture of CO<sub>2</sub></b></p> <p>Challenge solved: High CO<sub>2</sub> emissions from traditional and prolific industrial processes</p>
<p>TAM (Annual): &gt;\$1,000 B <sup>(1)</sup></p>	<p>TAM (Annual): &gt;\$2,500 B <sup>(2)</sup></p>	<p>TAM (Annual): &gt;\$1,000 B <sup>(2)</sup></p>	<p>TAM (Annual): &gt;\$100 B <sup>(2)</sup></p>	<p>TAM (Annual): &gt;\$200 B <sup>(2)</sup></p>
<p>Oxy-Combustion</p>	<p>Oxy-Combustion</p>	<p>CO<sub>2</sub> Working Medium</p>	<p>Oxy-Combustion</p>	<p>Potassium-Based</p>

8 Rivers has a large pipeline of additional ESG technologies under development and a business model that supports continuous innovation

Note: Ribbons represent number of active patents, with "P" signifying all patents pending. Allam-Fetvedt Cycle patents cover the core oxy-combustion techniques, which apply to other technologies across the portfolio.

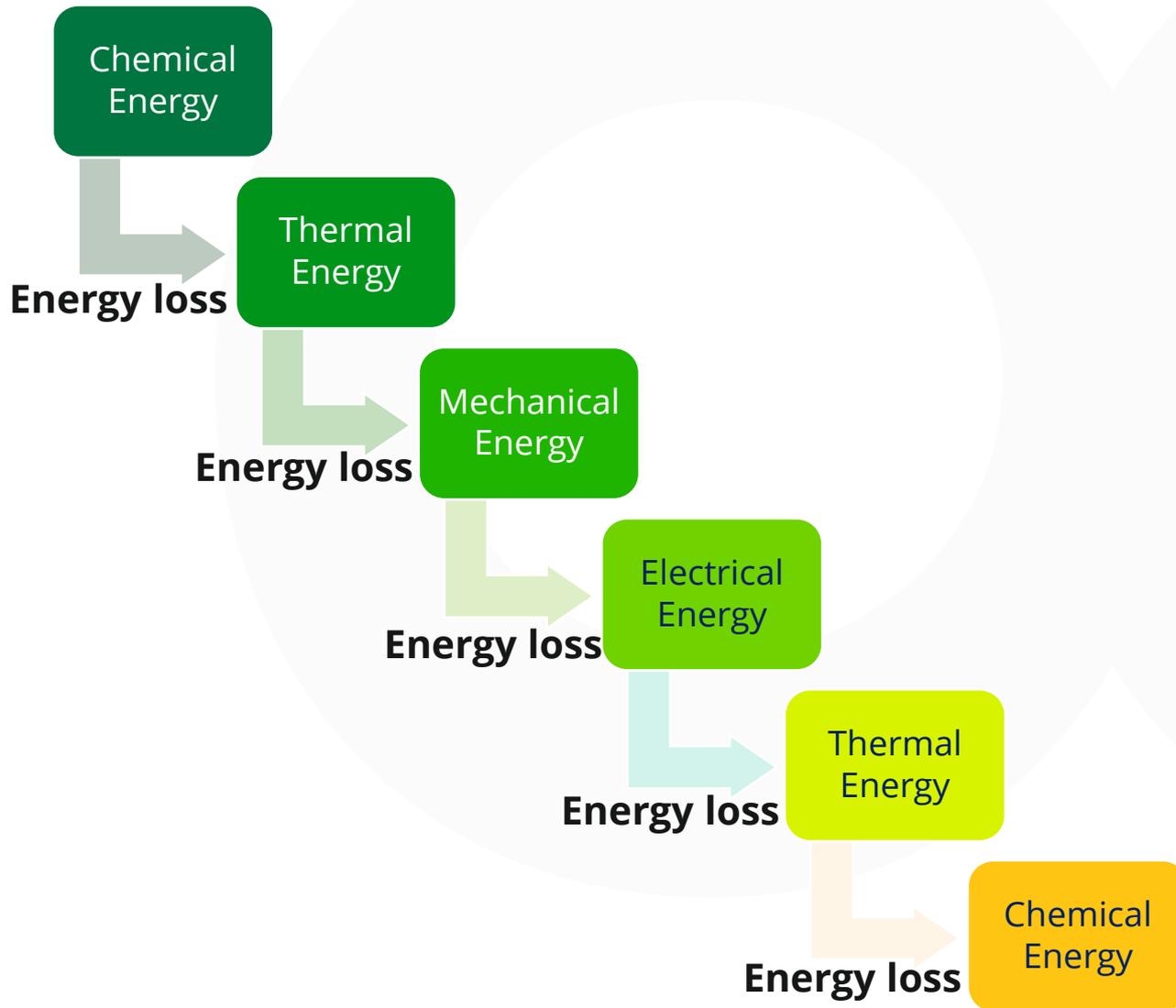
(1) Reflects total addressable markets (TAMs) of NET Power and 8RIVERS<sup>ENERGY</sup> combined. Note NET Power undertaking a concurrent fundraising round focused on NET Power technology licensing business.

(2) Reflects 8 Rivers' estimates based on end markets of saleable products from technology product streams.



## **Zero-emission industrial heat offerings**

# Assessing reality for emissions reduction, 8 Rivers approach



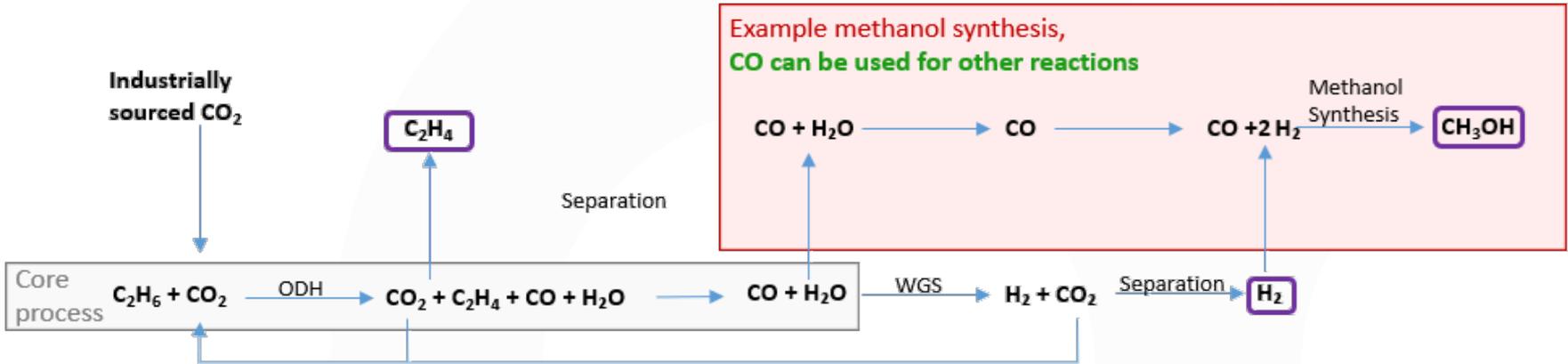
# Assessing reality for emissions reduction, 8 Rivers approach

Chemical  
Energy

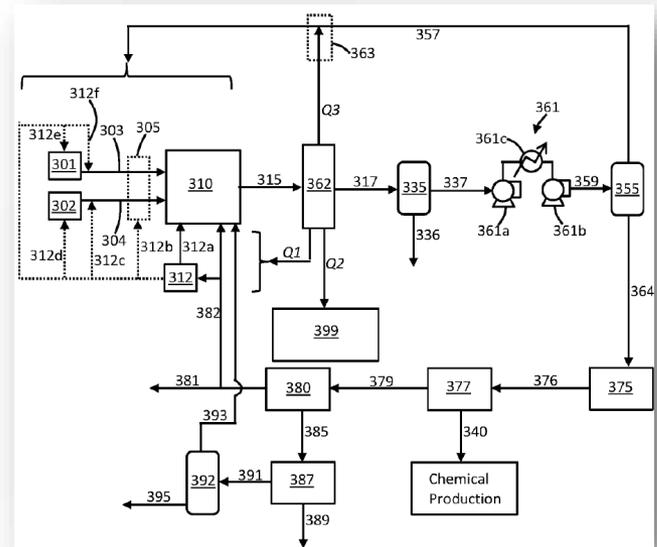
Energy loss

Thermal  
Energy

# COBOX – Clean Ethylene by 8 Rivers



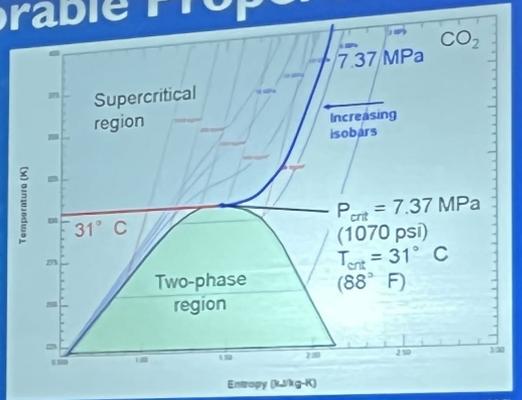
- **Save fuel costs** - for a typical world-scale 1M ton/yr cracker this would save \$8.55M/yr in fuel costs vs. traditional steam crackers (assumes: 3 MMBtu/ton  $C_2H_4$  savings at \$2.85/MMBtu)
- **Increase ethylene production** - by increased selectivity >90% vs. 80% of traditional steam crackers
- **Increase uptime** - By preventing catalyst coking issues via reverse Boudouard reaction
- **Net consumer  $CO_2$**  - ~1.76M tons  $CO_2$  avoided per 1M ton  $C_2H_4$  produced\*



\*breakdown: 1.57M tons  $CO_2$ /year consumed + 193k tons  $CO_2$  /year prevented from increased energy efficiency

# Carbon Dioxide Has Favorable Properties as a Working Fluid

- No freezing/chemistry management
- Thermally stable
- High heat transfer, natural convection near ambient temperature
- High density at liquid/supercritical conditions
- Nonflammable
- Non-toxic
- High diffusivity
- Low surface tension and viscosity
- Widely available, low-cost



Transition to Supercritical



Desublimation



# Technology Overview: Syn-Gas Allam-Fetvedt Cycle

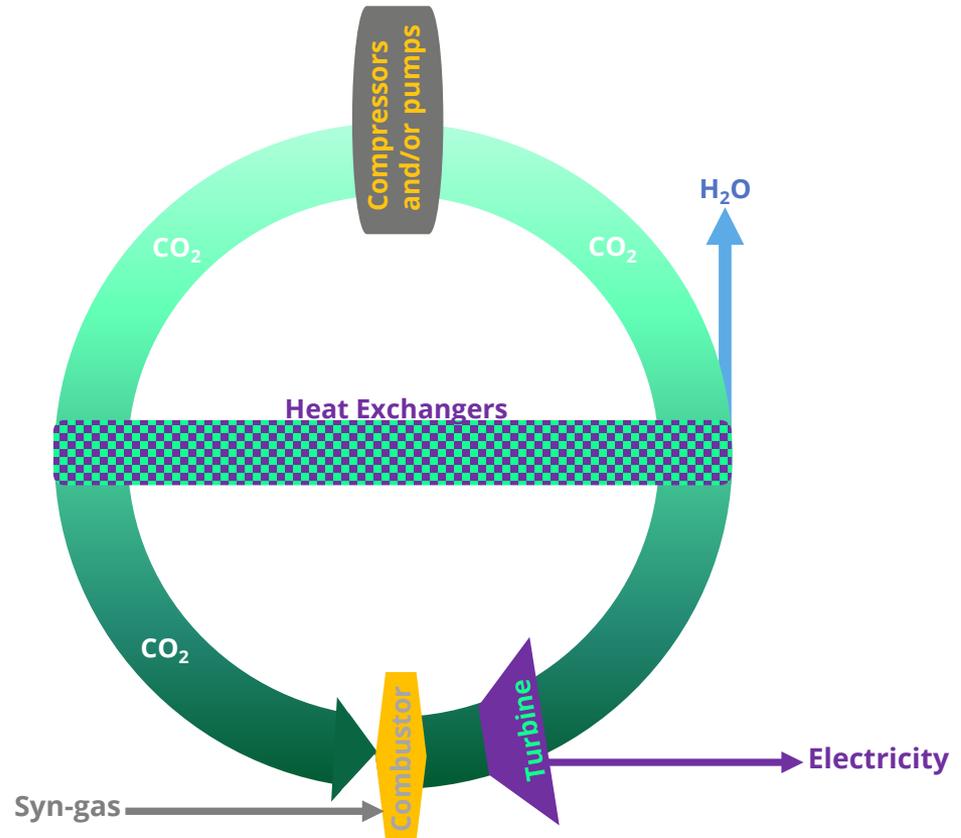
## Zero-Emissions Power

### What is it?

- The process uses synthesis gas as a feedstock to produce electricity while capturing ~100% of point source CO<sub>2</sub>

### How does it work?

- Fuel and oxygen are combusted in a CO<sub>2</sub> working fluid to generate electrical power
- High pressure, but low-pressure ratio turbine extracts the energy as electricity



# Technology Overview: Syn-Gas Allam-Fetvedt Combined Cycle

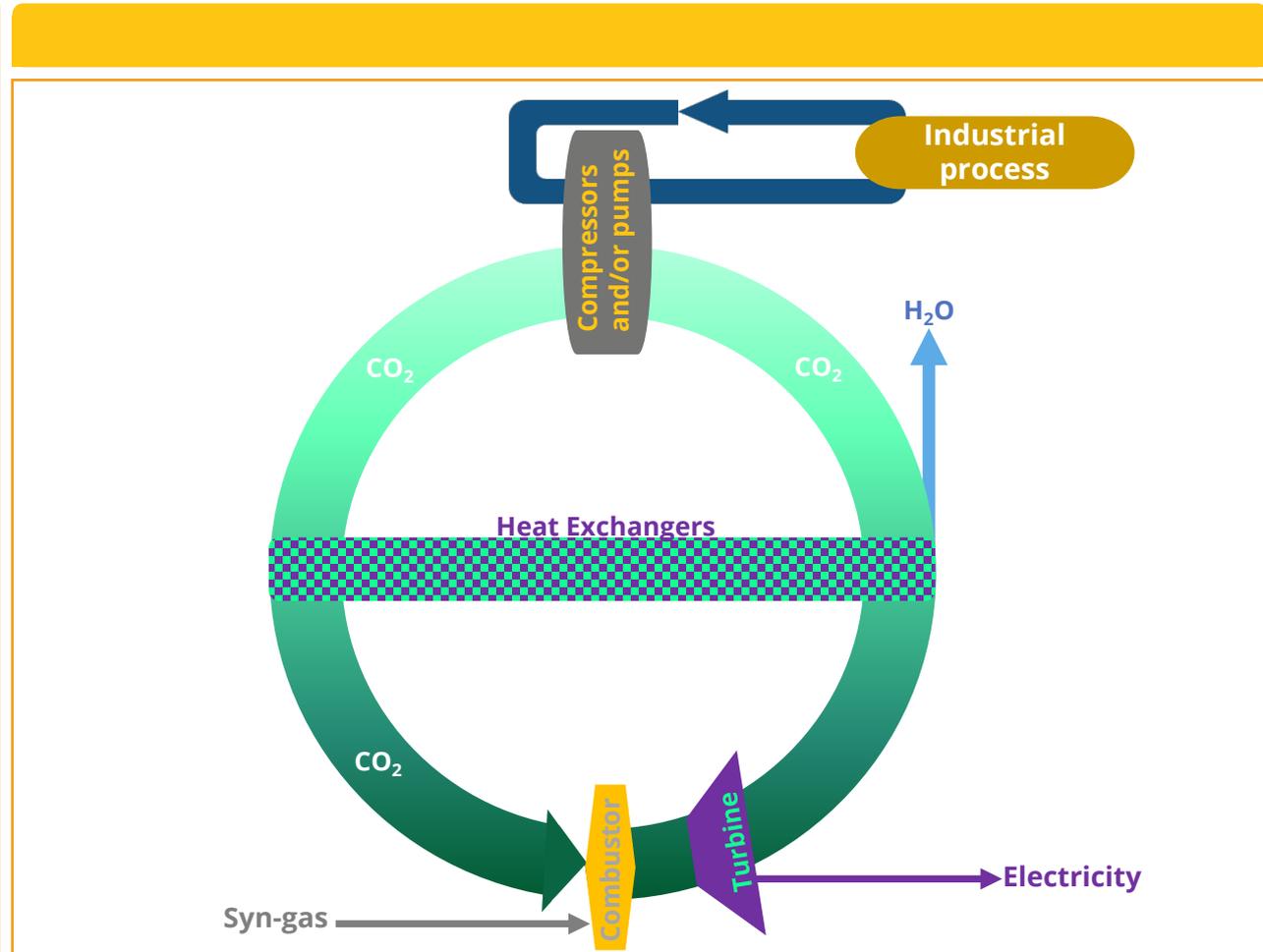
## Zero-Emissions Power and Industrial Heat

### What is it?

- The process uses synthesis gas as a feedstock to produce **electricity and industrial heat** while capturing ~100% of point source CO<sub>2</sub>

### How does it work?

- Much as the Allam-Fetvedt Cycle uses the heat of compression from within the ASU, the heat of compression within the cycle can also be used
- Temperatures achievable are lower
- Adiabatic compressors can be added if specific economics are favorable



# Technology Overview: Syn-Gas Allam-Fetvedt Combined Cycle

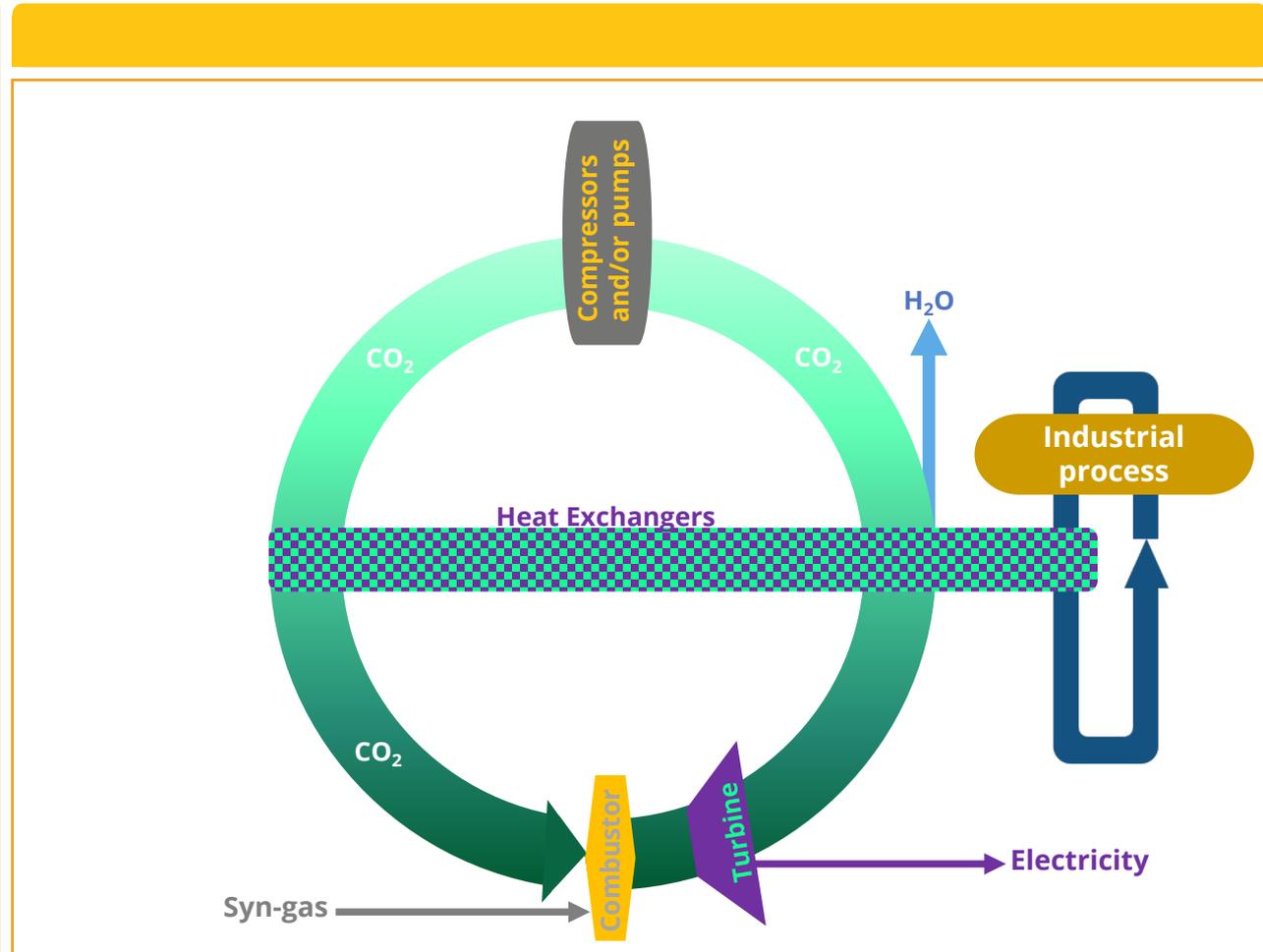
## Zero-Emissions Power and Industrial Heat

### What is it?

- The process uses synthesis gas as a feedstock to produce **electricity and industrial heat** while capturing ~100% of point source CO<sub>2</sub>

### How does it work?

- The stream leaving the turbine still has substantial thermal energy which can be used as an industrial heat source
- The industrial heat can be taken at many different temperatures, depending on the need
- Although shown as two different heat exchangers, they can be the same



# Technology Overview: Closed Loop Oxy-Fuel Heat

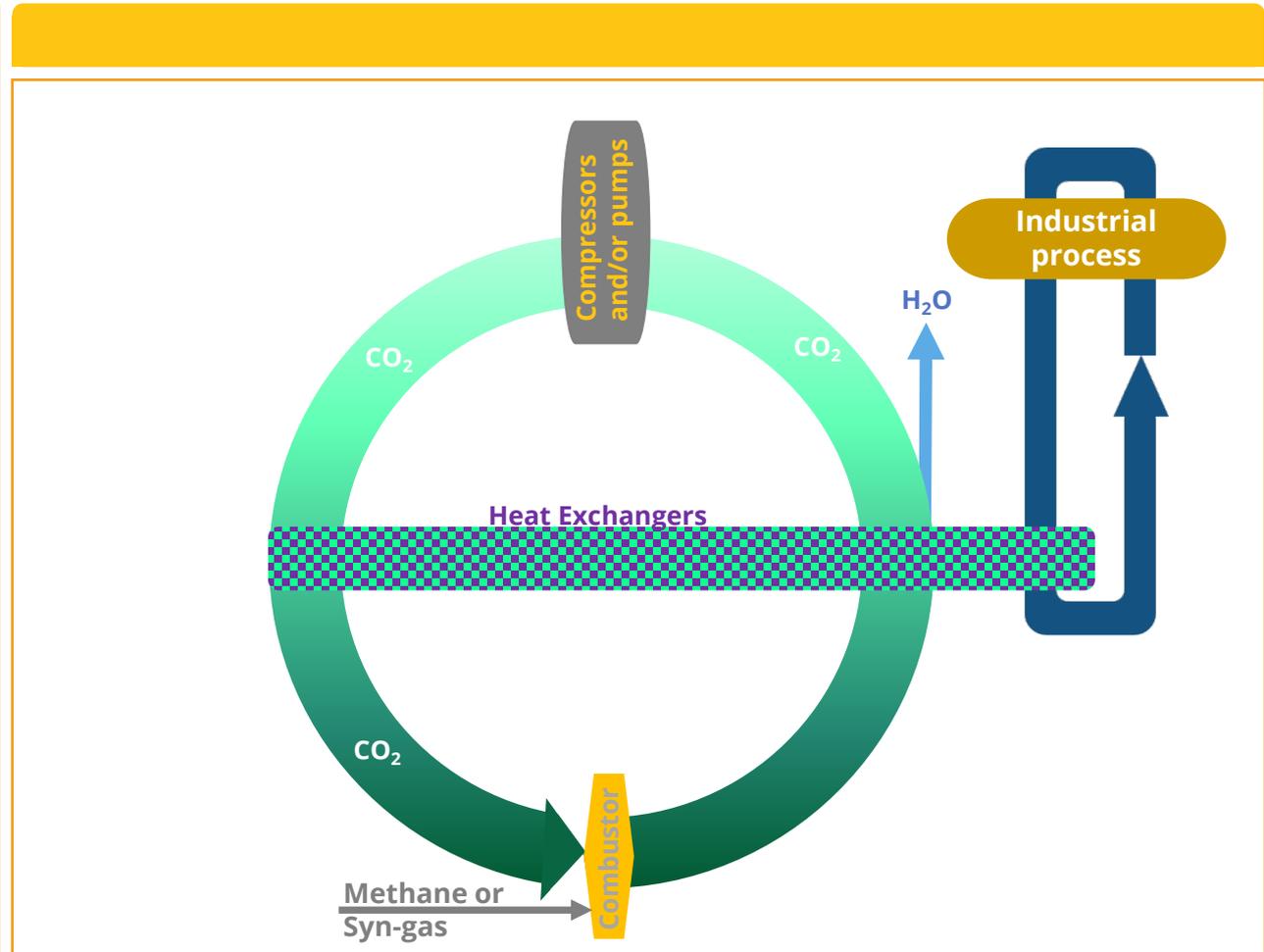
## Zero-Emissions Industrial heat

### What is it?

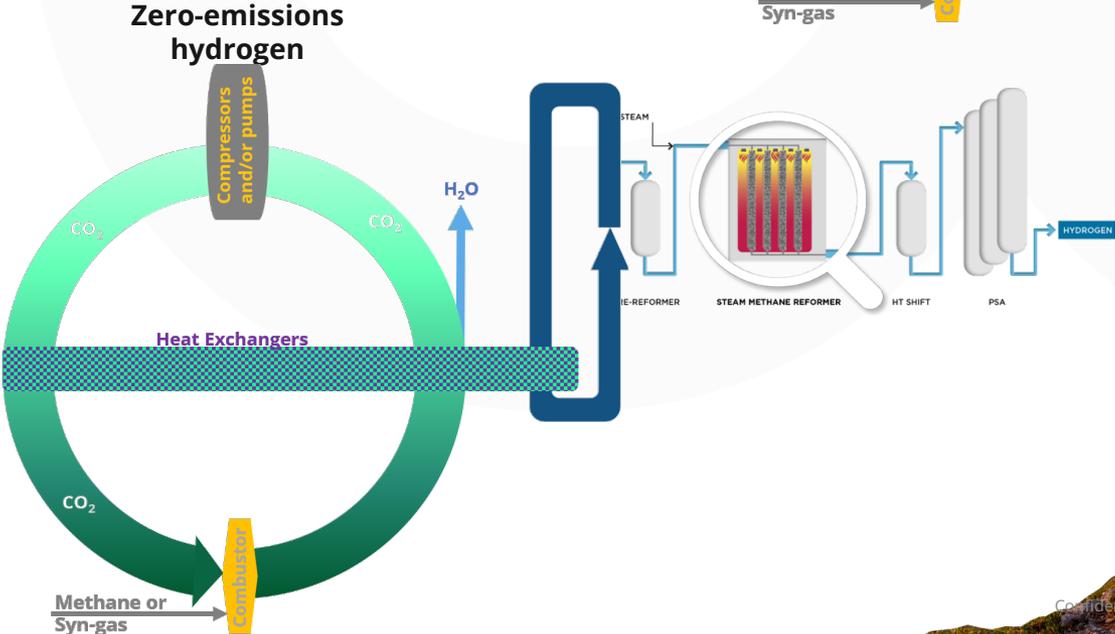
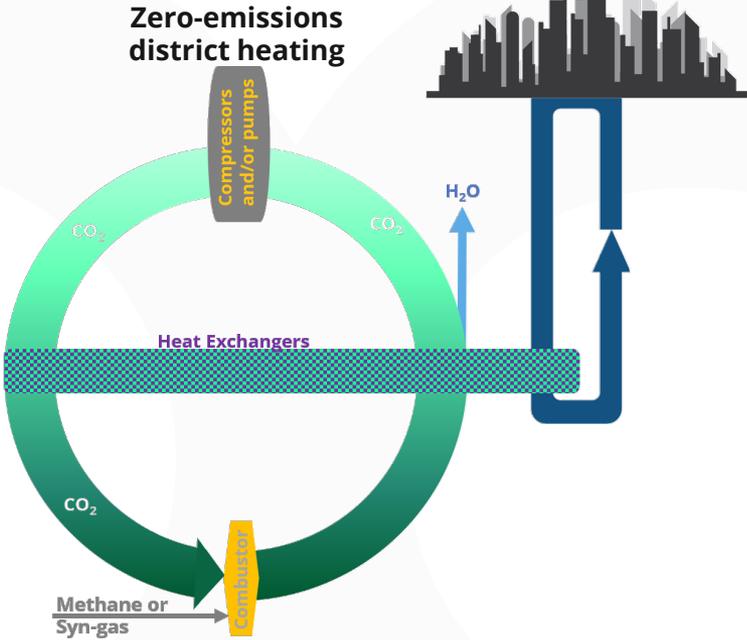
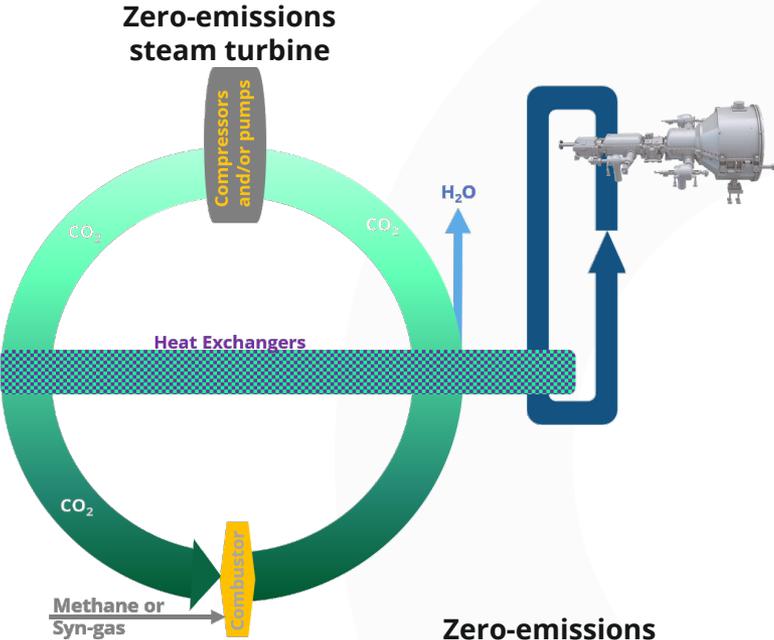
- The process uses natural gas or synthesis gas as a feedstock to produce industrial heat while capturing ~100% of point source CO<sub>2</sub>

### How does it work?

- Fuel and oxygen are combusted in a CO<sub>2</sub> working fluid to generate industrial heat for a multitude of applications
- Removal of the turbine completely minimizes the parasitic load of the compression and pumping
- Final choice of pressure for system depends on several variables and temperature demand of heat sink



# Industrial heat via sCO<sub>2</sub> oxy-combustion



# Technology Overview: KC8 Post-Combustion Carbon Capture

## Potassium-based Post-Combustion Carbon Capture Technology

### What is it?

- KC8 is an Australian technology licensing company developing a novel post-combustion capture solvent

### How does it work?

- The solvent, known as MK 3, works by precipitating potassium carbonate to allow for more CO<sub>2</sub> loading of the solvent
- $\text{CO}_2 + \text{K}_2\text{CO}_3 + \text{H}_2\text{O} \leftrightarrow 2\text{KHCO}_3$

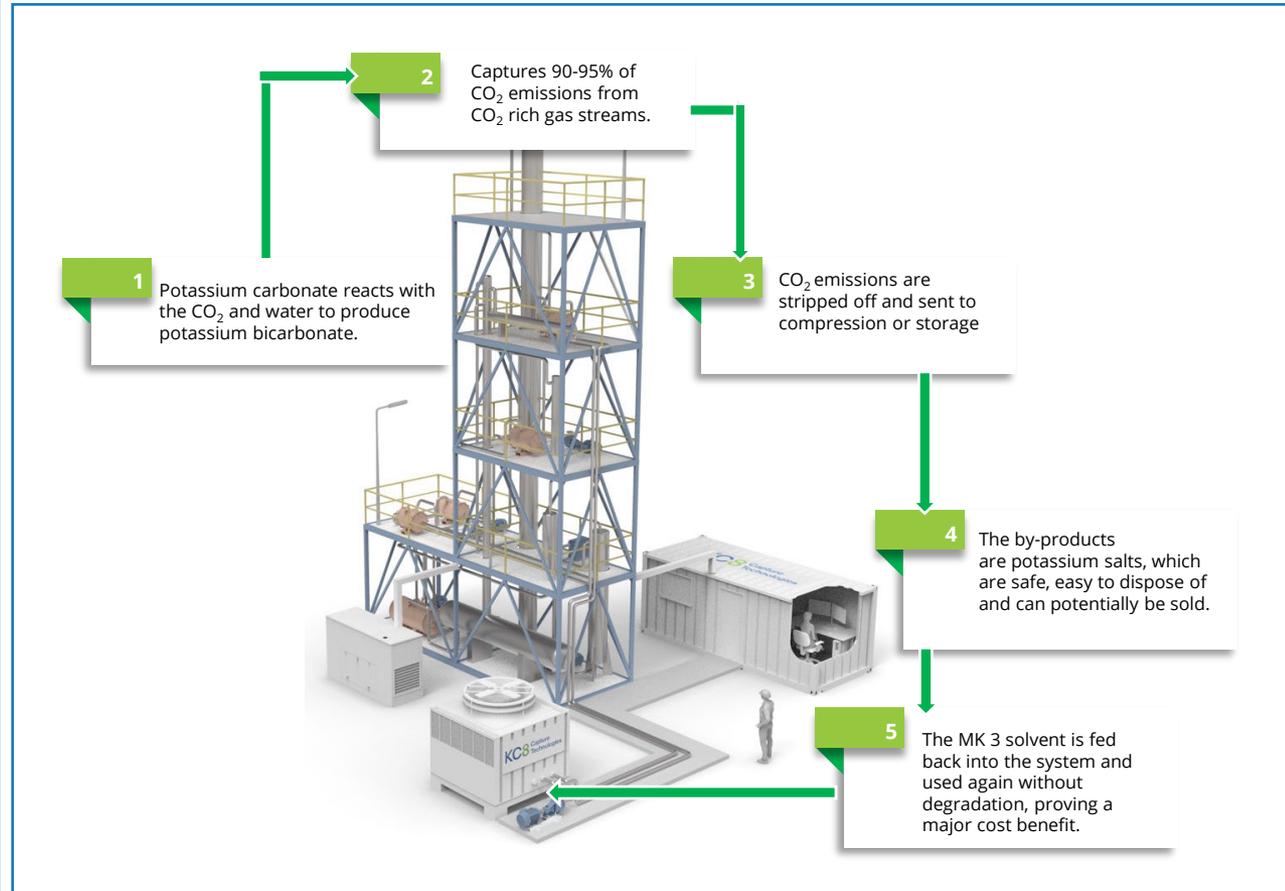
### Why is it different?

- Low cost (~ 50 % less than best amines)
- Low parasitic load (~30% less than amines)
- Raw materials are low cost and non-toxic
- Low solvent loss and replenishment requirements
- Smaller capex and equipment size
- Removal of pre-treatment equipment such as flue gas desulfurization (FGD)
- Multi-impurity capture of SO<sub>x</sub> and NO<sub>x</sub> to create valuable fertilizer by-products
- Oxygen and NO<sub>x</sub> tolerant

### Status

- Project Development Commenced & \$7.5M grant awarded by DOE

## MK 3 Process



# Technology Overview: KC8 UNO MK3 Post-Combustion Carbon Capture

## Potassium-based Post-Combustion Carbon Capture Technology

### What is it?

- KC8 (formerly UNOTech) is an Australian technology licensing company developing a novel post-combustion capture solvent

### How does it work?

- The solvent, known as MK 3 works by precipitating potassium carbonate to allow for more CO<sub>2</sub> loading of the solvent
- $\text{CO}_2 + \text{K}_2\text{CO}_3 + \text{H}_2\text{O} \leftrightarrow 2\text{KHCO}_3$

### Why is it different?

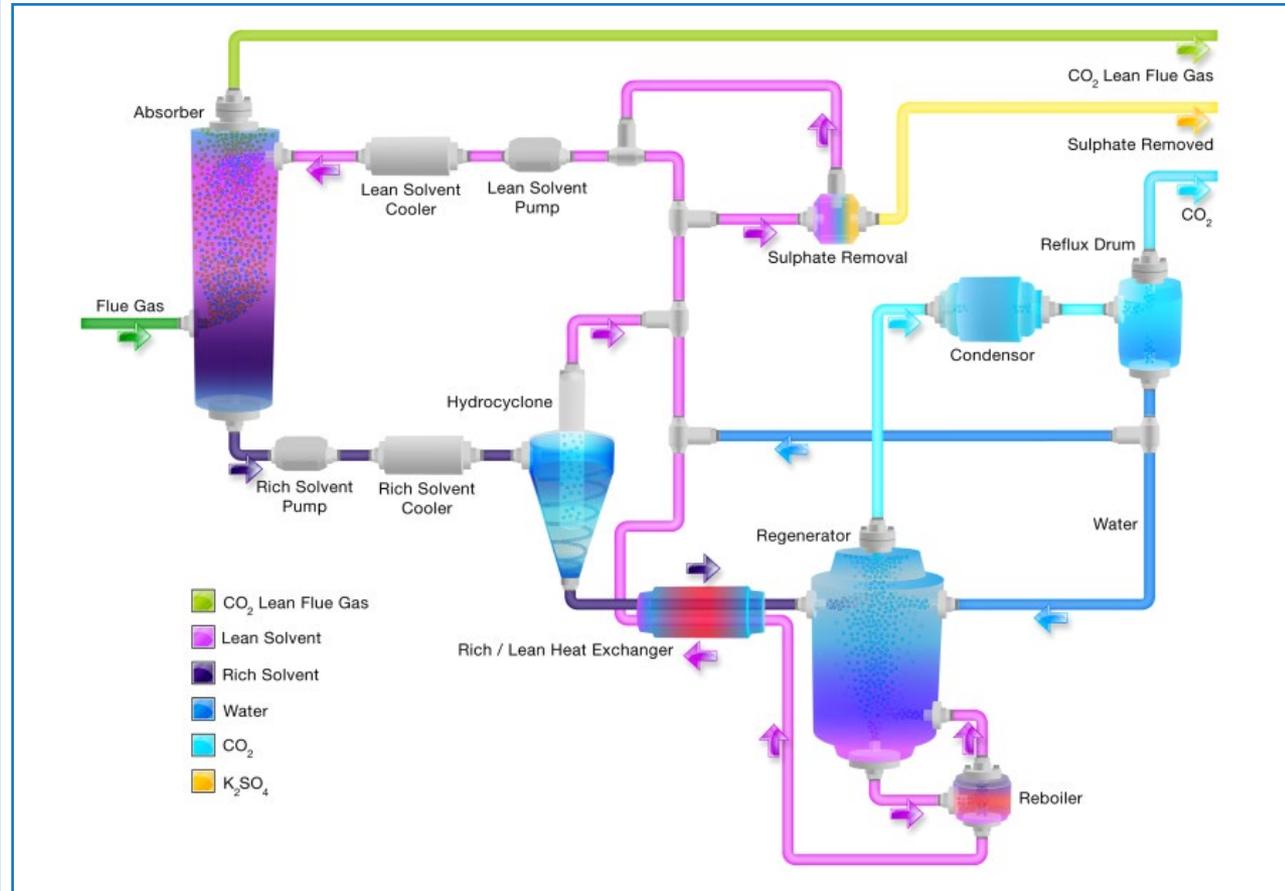
#### Low cost (~ 50 % less than best amines)

- Low energy of regeneration (15% less than best amines)
- Low raw material cost
- Low solvent loss and replenishment requirements
- Smaller equipment size
- Removal of pre-treatment equipment such as flue gas desulfurization (FGD)
- Multi-impurity capture of SO<sub>x</sub> and NO<sub>x</sub> to create valuable fertilizer by-products

### Status

- Pending \$7.5M grant by ARPA-E for FLECCS Phase II

### MK 3 Process Flow Diagram



An aerial photograph of a braided river system, showing multiple channels of water and sediment bars. The water is a light blue-grey color, and the sediment bars are a darker, brownish-grey. A large, semi-transparent circular graphic is overlaid on the image, consisting of three overlapping circles of varying shades of blue and grey. The text '8 RIVERS' is positioned at the bottom of the image.

8 RIVERS