

# SCOREKlean<sup>SM</sup>

Decarbonization Solutions for Steam Crackers



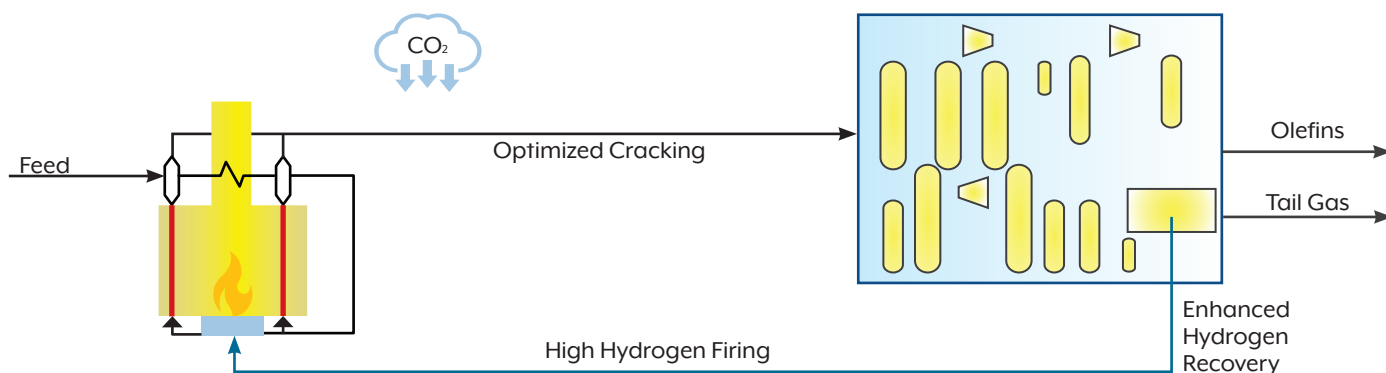
SCOREKlean<sup>SM</sup> design services offer a suite of decarbonization technologies for steam crackers that address direct, indirect, and other indirect emissions in the olefin value chain.

KBR has proven reference for over 84% hydrogen fired furnace

**Hydrogen firing** is the most accessible way to decarbonize olefins production, by reducing carbon in the fuel gas from pyrolysis furnaces

- 100% hydrogen combustion can be accommodated in SCORE<sup>®</sup> Furnace proprietary burners
- Connections existing in floor fired burners can be used to convert to 100% hydrogen firing
- Stable 100% hydrogen firing has been proven in our test facilities over a range of operating conditions
- Fuel flexibility is retained should hydrogen not be available
- Our ethane crackers have operated for over 15 years with fuel gas hydrogen content over 84 mol%

**Enhanced hydrogen recovery** designs maximize the recovery of hydrogen from the recovery section for firing in pyrolysis furnaces.

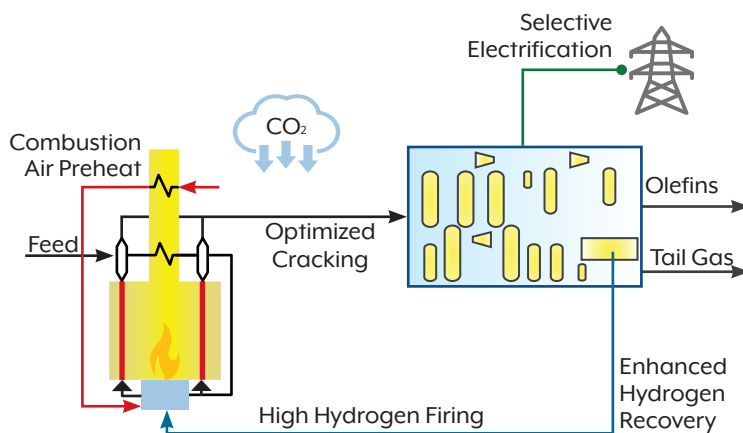


KBR SCOREKlean services provides Low CO<sub>2</sub> cracker design, emission reductions without requiring carbon capture or an external source of hydrogen. Our emission reduction designs remove carbon from the pyrolysis furnace firebox and move heat from the steam system into the process.

- **Cracking furnace design point optimization** uses the enhanced performance of SCORE<sup>®</sup> services to design pyrolysis furnaces to reduce energy input
- High severity and pressure cracking using SCORE<sup>®</sup> designed technology reduces furnace firing rate and recovery section power requirements
- **Combustion air preheat and selective recovery section electrification** moves heat from the steam system to the cracking process, reducing fuel consumption
- **Hydrogen firing** combined with **enhanced hydrogen recovery** decarbonizes furnace flue gas

KBR has leveraged its experience in **unconventional feed cracking** for bio-sourced and recycled feedstock.

Standalone low CO<sub>2</sub> cracker designs can reduce direct emissions by 70%

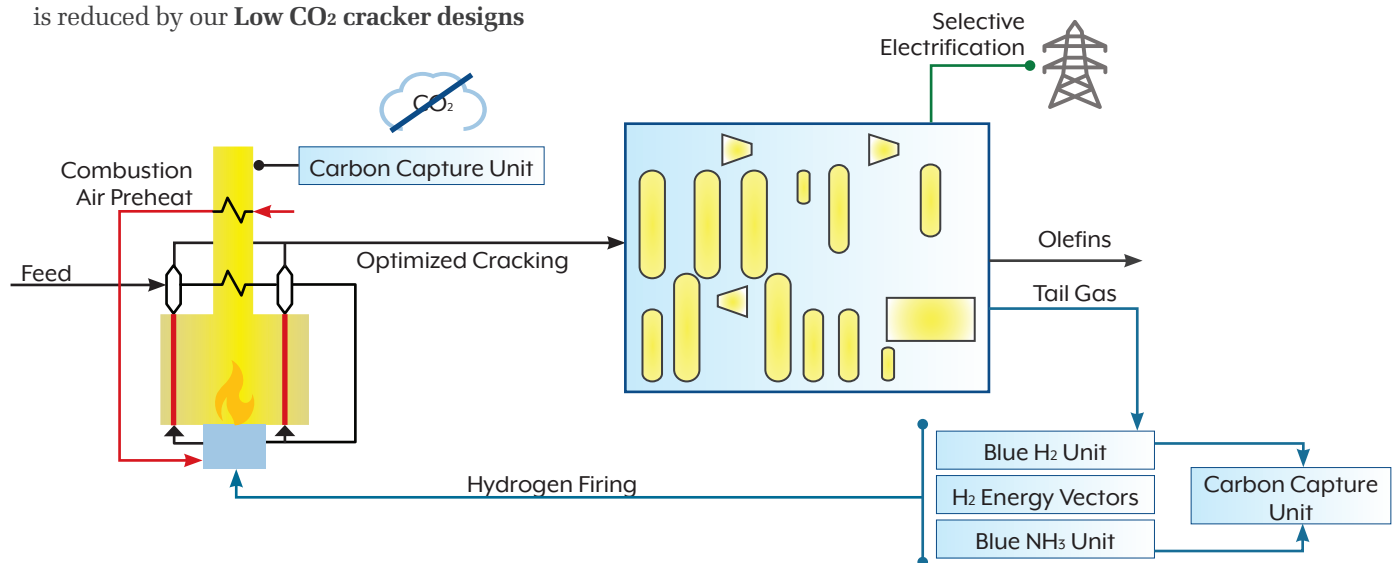


Aspects of Low CO<sub>2</sub> Cracker Designs are suitable for Greenfield and Revamp application

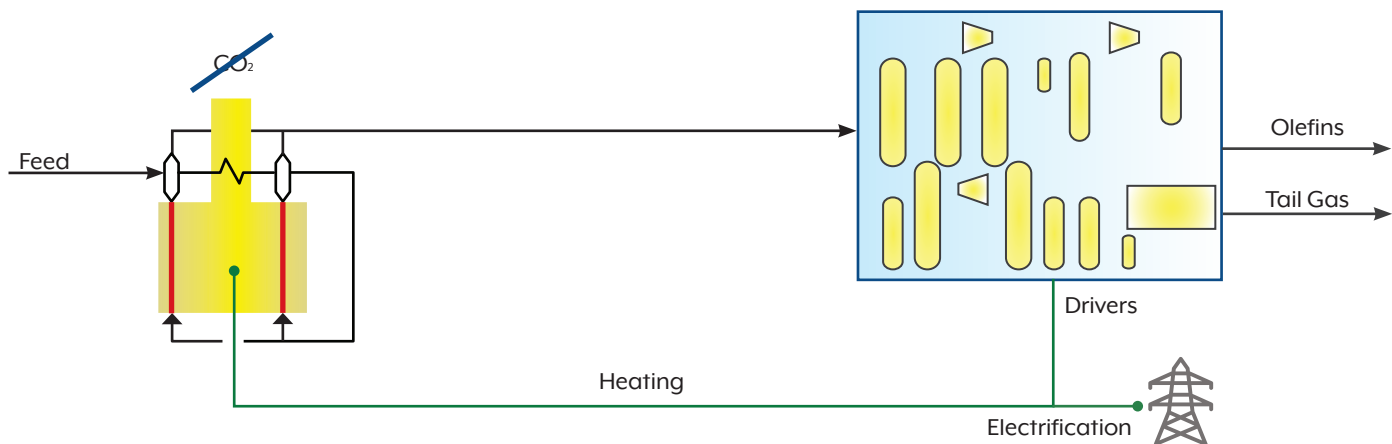
**Net Zero steam cracker designs** eliminate carbon emissions either at the combustion stage in the firebox or through post-combustion carbon capture. Blue hydrogen, Blue ammonia, or carbon capture units can be integrated with KBR's low CO<sub>2</sub> cracker designs, for a net zero cracker.

KBR Net Zero cracker designs remove direct carbon emissions from steam crackers

- **Tail gas utilization** designs use methane in tail gas to produce a decarbonized energy carrier such as Blue hydrogen, or convert the methane into other chemical feedstocks, such as Blue ammonia.
- Hydrogen import and energy vectors may be used to supplement hydrogen from **enhanced hydrogen recovery** in the cracking process, without carbon capture
- Post-combustion carbon capture facility size is reduced by our **Low CO<sub>2</sub> cracker designs**



KBR is developing concepts for **steam cracking furnace electrification**, for not to completely removing the flue stacks and direct emissions from pyrolysis furnaces.



KBR designed, built, and operated an electrified cracking pilot plant in the 1990s, a miniature version of one of our pyrolysis furnaces.

SCORE<sup>®</sup> designed feed-flexible olefin production technology maximizes the yield of ethylene. Our high-yield furnaces, combined with optimized recovery systems are energy and cost efficient. With 70+ years experience, KBR leads the way in innovating olefin production routes, and decarbonizing olefin production.

## SCOREKlean: Decarbonization Solutions for Steam Crackers

Scope 1

Scope 2

Scope 3

Low CO<sub>2</sub> Designs Utilizing Optimized Process Performance, Air Preheat, and Selective Electrification

Cracking Unconventional Recycled and Bio-Sourced Feedstocks

Hydrogen Firing

Net Zero Integration with Blue Hydrogen or Carbon Capture

Furnace Electrification

## ABOUT KBR, INC.

We deliver science, technology and engineering solutions to governments and companies around the world. KBR employs approximately 32,000 people performing diverse, complex and mission-critical roles in 34 countries.

**At KBR, We Deliver.**



Scan for more information  
about KBR Technology Solutions

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