



MEMBRANES:

Commercial and Technical Advances in Industrial Applications – Update 2023

STUDY PRESENTATION

December 2023

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Membranes: Commercial and Technical Advances in Industrial Applications – Update 2023

(Completed December 2023)

The Catalyst Group Resources (TCGR) identifies MEMBRANES as a crucial industry subject that requires frequent reanalysis, providing critical new assessments regarding industry shifts, growth and development to our clients, supporting their continued success and competitiveness. Like all TCGR studies, it is **for the industry, by the industry**, indicating opportunities for advancement and noting the challenges which remain. The search for competitive advantage in the application of membranes continues unabated. Let us help you find yours!

Exclusive TCGR Analysis: Membranes

2016- ***Membranes in Separations: Commercial Advances in Refinery, Petrochemical/ Chemical and Industrial Gases Applications***, delivers comprehensive global data on market size, growth rates and competitor profiles for applications across the separations industry, including materials and technologies in industrial gas separations, natural gas purification and olefin/paraffin separation.

Client-Rated: An Invaluable Report with Exceptional Analyses!

2017 & 2019- ***The Separations Report: Commercial, Technical and R&D Assessment in Refining, Petrochemical/Syngas, Natural Gas and Industrial Gases***, homes in on several advanced separations technologies in emerging and booming applications, such as hydrogen production, carbon capture, natural gas purification and biofuels, while ensuring the inclusion of decarbonization benefits found through process intensification and innovative technologies.

Differentiated Thinking and Content Provides Clients with Unique Acumen!



The global drive toward Net Zero by 2050 offers enormous opportunities for membranes.

- Carbon capture is a huge opportunity for membrane developers but has technical challenges to overcome.
- Biogas purification, ethanol dehydration, and hydrogen recovery and purification will all see better than average growth rates.
- The Robeson upper bound for separation of gases (2008) is being overcome using new polymers, inorganic materials and composite membranes.



A Must-Have for Anyone in the Refining, Petrochemicals/Syngas, Natural Gas and Industrial Gases Markets!

2023- Membranes: Commercial and Technical Advances in Industrial Applications:

- Assesses the development, implementation and implications of membranes in separations with emphasis on the resulting improvements that affect carbon intensity (CI), costs, purity and functionality of the products, including energy efficiency gains, waste/by-product minimization and product performance improvement.
- Focuses on significant areas of interest, some capricious, including the hydrogen economy, carbon circularity, product sustainability and climate change, in addition to technical advances expected to change the competitive landscape.
- Includes the new examination of relevant decarbonization and energy transition applications, with forecasts of market trends and analyzing societal forces, some with potential industry impact through 2033, in significant detail.
- Analyzes competitive and strategic implications of advances in membranes, including the timing of their commercial implementation and impacts on the developers and partners.
- Offers unique competitive insight, vital analyses and strategic guidance for innovation, growth and investment opportunities across the entire value chain.

Section Highlights:

Section III. Market Size, Growth and Commercialization Status documents the market size and growth for membrane-based separations by application and includes an assessment of key players.

Section IV. Advanced Separation via Membranes delineates recent developments from R&D towards pilot and commercialization across applications, divided by gas and liquid separations, including air separation, aromatics separations, hydrogen and natural gas purification, and refinery applications.

Section V. Emerging Applications for Membranes is a deep, technical dive into applications that are expected to become prevalent over the coming decade, including fuel cells and electrolyzers, membrane reactors, carbon capture and crude oil refining. Newly synthesized polymers could yield cost reductions for these applications.

Section VI. Technological Advances in Membranes documents recent developments by membrane type and chemistry, including facilitated transport, hybrid membranes and ion conductive membranes, and the implication of artificial intelligence on membrane design and synthesis.

Section VII. Competitive and Commercial Impacts provides an insightful analysis of the market and competitive landscape along with the future impacts of new technologies and applications.

Recent advances are in further development to displace incumbent technologies. Improving energy efficiency via improved separation and purification processes, increases the bottom line of manufacturing plants while reducing greenhouse gas emissions. To remain competitive in production costs and leverage leading technologies to provide distinguishable products and process capabilities, refiners, petrochemical/ chemical producers and suppliers of industrial gases must adapt their practices to survive and thrive in these markets.



Membranes: Commercial and Technical Advances in Industrial Applications – Update 2023

Membranes – Update 2023 complements an ongoing portfolio of well received TCGR studies published in the last five years (noted below), and our prestigious membership programs, the **Catalytic Advances Program (CAP)** and the **Industrial Energy Transition and Decarbonization (IETD) Consortium** (*formerly the CO₂ Capture and Conversion (CO₂CC) Program*).

- ***Catalysts and Catalyst Manufacturing Methods for Decarbonization***
- ***Advanced Materials for CO₂ Capture and Separation***
- ***Catalysts and Materials to Address the Energy Transition: Fuel Cells, Batteries, and Energy Storage***
- ***Advances in Direct Air Capture of CO₂***
- ***Compact Light-Weight CO₂ Capture Technologies for Small- to Medium-scale CO₂ Emitters***
- ***The Separations Report - 2019: Commercial, Technical and R&D Assessment in Refining, Chemicals/Syngas, Natural Gas and Industrial Gases (second biennial edition)***

All are available for immediate purchase and with **delivery today** via pdf!

TCGR's unique background with 40+ years of consulting and industry experience, coupled with our own global Dialog Group®, utilizing experts in membranes and separations for this exclusive report, ensures proficient capability in deliverable production beyond other sources.



As it does in each of its industrially focused multi-client studies, TCGR has received input from "charter" subscribers to help shape the report's final scope/TofC so that it covers and emphasizes the most pertinent content due to the large volume of research and the membrane-based approaches and application areas that might be of interest.



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Order the **Membranes: Commercial and Technical Advances in Industrial Applications - Update 2023**, delivered as a PDF file (site license). The post completion cost of the report is \$24,500.

- *** We are subscribers to the 2019 edition of **The Separations Report** and are therefore entitled to a \$1,000 discount off the subscription rate. ***

This report is timely and strategically important to those industry participants and observers both monitoring and investing in the development and implementation of membranes in separations for application in the refining, petrochemical/chemical and industrial gases industries. TCGR's report, based on technology evaluations, commercial/ market assessments and interviews with key players goes beyond public domain information. As a result, subscribers are requested to complete and sign the "Order Form and Secrecy Agreement."

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