



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

STUDY PRESENTATION

December 2023

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

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(Study 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 compliments 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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CONTENTS

(completed December 2023)

SECTION I. INTRODUCTION.....	1
A. INTRODUCTION/BACKGROUND	1
B. SCOPE AND OBJECTIVES	3
C. METHODOLOGY	3
D. REPORT CONTRIBUTORS	4
E. GLOSSARY	5
SECTION II. EXECUTIVE SUMMARY	9
A. MARKET SIZE AND GROWTH	10
B. ADVANCED SEPARATIONS VIA MEMBRANES	12
1. Gas Separations	12
2. Liquid Separations	12
C. EMERGING APPLICATIONS FOR MEMBRANES	13
D. TECHNICAL ADVANCES IN MEMBRANES	15
E. COMPETITIVE AND COMMERCIAL IMPACTS	16
SECTION III. MARKET SIZE, GROWTH, AND COMMERCIALIZATION STATUS.....	17
A. ESTABLISHED MARKETS	18
B. KEY PLAYERS, COMMERCIAL AND DEVELOPING APPLICATIONS.....	20
C. EMERGING MARKETS.....	22
D. NEW MARKETS.....	23
E. COMMERCIALIZATION STATUS AND PROSPECTS.....	24
F. THE INDUSTRY SPEAKS – INTERVIEWS.....	26
1. Compact Membrane Systems (CMS).....	26
2. Membrane Technology and Research (MTR).....	27
3. UniSieve	28
G. DRIVERS.....	29
H. REFERENCES	30

SECTION IV. ADVANCED SEPARATIONS VIA MEMBRANES	31
A. GAS SEPARATION	31
1. Natural Gas Processing.....	32
2. Hydrogen Separation	33
a. Hydrogen Deblending.....	34
3. Air (Oxygen/Nitrogen) Separation	36
4. Biomass/Biogas.....	38
5. Carbon Dioxide	40
6. Helium Recovery.....	43
7. Conclusions	44
B. LIQUID/LIQUID SEPARATIONS.....	44
1. Aromatics Separations	45
a. Xylene Isomers Separation	45
2. Aromatic/Aliphatic Separations	46
3. Sulfur Removal.....	46
4. Lube Oil Processing.....	46
5. Solvent Dehydration (Pervaporation)	47
6. Acid Dehydration	47
7. Biorefinery Applications	49
C. REFERENCES	52
SECTION V. EMERGING APPLICATIONS FOR MEMBRANES.....	55
A. FUEL CELLS AND ELECTROLYZERS.....	55
1. PEM.....	55
a. PEM Fuel Cell Industry Leaders	56
b. PEM Industry News	58
2. SOFC/SOEC	58
3. Water Electrolysis for Green Hydrogen	60
a. AWE	61
b. PEM.....	62
c. AEM.....	63
4. Electrochemical CO ₂ Conversion	64
B. LITHIUM EXTRACTION AND PURIFICATION	65
1. Drivers/Incentives for Li Extraction and Purification	65
2. Membrane-based Li Extraction Technologies	66
3. Industrial Projects.....	67
a. Tenova (TAT), Clayton Valley and BASF.....	67
b. Rincon DXP, ANSTO and Enirgi	68

c. Eramet, IFPEN and Cordilera.....	69
C. MEMBRANE REACTORS	71
1. Drivers for Membrane Reactors	71
2. EU-funded Projects for Membrane Reactors	71
D. CARBON CAPTURE	73
1. Drivers/Incentives for CO ₂ Capture	73
2. Membrane-based CCS/CCU Technologies	74
a. Post-combustion Capture	75
b. Pre-combustion Capture	76
3. Industrial Projects.....	78
E. CRUDE PROCESSING.....	80
F. NGL FRACTIONATION	84
1. Drivers for NGL Fractionation	84
2. Membrane-assisted NGL Fractionation Industry Leaders	85
G. OLEFIN/PARAFFIN SEPARATION.....	88
1. Drivers for Olefin/Paraffin Separations	88
2. Membranes for Olefin/Paraffin Separations	88
3. Olefin/Paraffin Separations Industrial Players	90
a. Compact Membrane Systems (CMS)	90
b. Imtex	91
H. FLOW BATTERIES AND SOLID-STATE BATTERIES	92
1. Flow Batteries.....	92
a. Drivers for Membranes in Flow Batteries	92
b. Technical and Market Overview of Ion Exchange Membrane in Flow Batteries.....	93
2. Solid-State Batteries	95
a. Drivers for Membranes in Solid-State Batteries.....	95
b. Solid-State Batteries Film Forming Process	96
I. CONCLUSION	97
J. REFERENCES	98

SECTION VI. TECHNICAL ADVANCES IN MEMBRANES 103

A. MEMBRANE MATERIALS.....	103
1. Polymeric Materials.....	103
2. Inorganic Membranes.....	105
3. Two-dimensional Materials	107
B. HYBRID (MIXED-MATRIX) MEMBRANES.....	109
C. FACILITATED TRANSPORT MEMBRANES.....	111
D. ION CONDUCTIVE MEMBRANES	113

1.	Polymer Electrolyte Membranes	114
2.	Anion-exchange Membranes	115
3.	Batteries	118
E.	REACTIVE MEMBRANES	119
1.	Propane Dehydrogenation (PDH)	119
2.	Ammonia/Synthesis/Decomposition	120
3.	CO ₂ Conversion	121
F.	MEMBRANE CONTACTORS	122
G.	IMPACT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	123
H.	CONCLUSIONS	127
I.	REFERENCES	128
SECTION VII. COMPETITIVE AND COMMERCIAL IMPACTS		135
A.	TECHNICAL AND COMMERCIAL PROGRESS	135
B.	MARKET AND COMPETITIVE LANDSCAPE	138
C.	CHALLENGES AND OPPORTUNITIES	138
D.	STRATEGIES FOR IMPLEMENTATION AND GROWTH	141
E.	REFERENCES	142

FIGURES

Figure I-A-1.	Elevation drawing of the complete 2-stage Optiper™ membrane skid installed at Braskem. Membrane stages (orange) are labelled, and balance of equipment (blue) is shown to scale.	2
Figure III-1.	Gas separation membrane market size and growth rates, as reported by public sources.	18
Figure IV-A-1.	The cost of converting an existing natural gas pipeline for hydrogen use is substantially lower than building a new pipeline, ranging from about 10% to as high as 30%.	35
Figure IV-A-2.	Linde's HISELECT demonstration plant in Dormagen, Germany, which can extract hydrogen from natural gas/H ₂ blends.	36
Figure IV-A-3.	Container-mounted air separation unit.....	37
Figure IV-A-4.	Biomethane production facility.....	38
Figure VI-A-5.	Block flow diagram for three-stage biogas separation process.	39
Figure IV-A-6.	Block flow diagram for post-combustion membrane CO ₂ capture process.....	41
Figure IV-A-7.	Block flow diagram for MTR's CO ₂ capture pilot plant at the Wyoming Integrated Test Center.....	42

Figure IV-A-8.	Diagram showing membrane plus PSA combination for helium recovery.....	43
Figure IV-B-1.	Xylene isomer separation with MFI zeolite membranes.	45
Figure IV-B-2.	CMS membranes for xylene isomer separations.	45
Figure IV-B-3.	Zeolite membrane integration with lube oil processing.....	46
Figure IV-B-4.	MTR's SolvSep® process for dehydration of organic solvents.	47
Figure IV-B-5.	Process configurations for acetic acid dehydration with membranes. (a) vapor/liquid equilibrium data for acetic acid/water mixture (b) VLE modeling of the dehydration of acetic acid/water through hybrid pervaporation/distillation technology.....	48
Figure IV-B-6.	Water permeance versus water/ acetic acid separation factor.	48
Figure IV-B-7.	Hydrothermal liquefaction (HTL) process.....	50
Figure IV-B-8.	Estimated cost and process energy reductions for biochemicals production.	51
Figure IV-B-9.	BDO production pathway.	51
Figure IV-B-10.	2,3-Butanediol (BDO) separation process.	52
Figure V-A-1.	Schematic explanation of the working principle of PEMFCs.....	57
Figure V-A-2.	Thermally self-sustaining energy storage system.	59
Figure V-A-3.	Diagram of a typical alkaline electrolysis cell.....	61
Figure V-A-4.	Base case levelized production costs of different CO ₂ electrochemical conversion routes.....	64
Figure V-B-1.	Distribution of global end-use markets of lithium.	65
Figure V-B-2.	Map showing type and relative size of global lithium resources.	66
Figure V-B-3.	Diagrammatic overview of initial flowsheet for Clayton Valley South lithium brine treatment.	68
Figure V-B-4.	Enirgi Group lithium carbonate plant (Engineering, Procurement & Construction)....	69
Figure V-B-5.	Eramet two-step process developed for lithium extraction and concentration.	70
Figure V-C-1.	MACBETH project set-up and the way beyond.	72
Figure V-D-1.	World Bank carbon pricing dashboard map 2023 version.	74
Figure V-D-2.	Performance comparison of the hybrid-integrated membranes relative to other membranes developed for CO ₂ capture.....	75
Figure V-D-3.	The flexibility of the mixed matrix membrane and the quasi-continuous zeolite phase within the membrane.	76
Figure V-D-4.	Schematic representation of the mixed-matrix membrane (MMM) fabricated by a solid-solvent processing (SSP) strategy.	77
Figure V-D-5.	SW membrane element structure (left) and performance of OSU's transformational FTMs vs. the Robeson upper bound (right).	78
Figure V-D-6.	Schematic of the two-stage membrane process.	78
Figure V-D-7.	Actual skid-mounted membrane plant model.....	79
Figure V-D-8.	MTR system at TCM.	80
Figure V-E-1.	Synthetic pathway toward N-aryl-linked spirocyclic polymer.	81

Figure V-E-2.	Fabrication of hydrophobic polyamide nanofilms with MOAs.	82
Figure V-E-3.	Synthesis and properties of DUCKY polymers.	83
Figure V-E-4.	Structure and characterization of thermally cross-linking membranes.	84
Figure V-F-1.	NGL recovery processes: (a) absorption, (b) adsorption, (c) membrane, and (d) cryogenic.	85
Figure V-F-2.	LPG-Sep™ process.	86
Figure V-F-3.	Air Liquide's All-Membrane Solution™ for natural gas production.	87
Figure V-F-4.	Membrane process for NGL recovery.	87
Figure V-G-1.	Schematic illustrating olefin generation and separation in a petrochemical cracking unit.	88
Figure V-G-2.	The milestones of ZIF-8 membrane research for C ₃ H ₆ /C ₃ H ₈ separation.	89
Figure V-G-3.	Conventional C ₄ enrichment vs. hybrid Permylene™ membrane/distillation process.	90
Figure V-G-4.	Conventional C ₄ enrichment vs. hybrid Permylene™ membrane/distillation process.	91
Figure V-H-1.	Schematic of a typical flow battery and its used porous ion conducting membrane.	93
Figure V-H-2.	Schematic representation of the different interfaces in solid-state batteries.	95
Figure V-H-3.	Schematic of different interfaces in solid-state batteries.	96
Figure VI-A-1.	Molecular structure of PBI (A) and HAB-6FDA-CI (B) Moon, 2019.	104
Figure VI-A-2.	Examples of high permselectivity of light gases in hollow carbon fiber membranes. The temperature corresponds to the pyrolysis temperature during preparation of the carbon membrane.	106
Figure VI-A-3.	CO ₂ permeance and selectivity in binary mixtures with (a) methane and (b) nitrogen as a function of temperature.	106
Figure VI-A-4.	Hydrogen permeability performance of Pd/ZrN/V membranes.	107
Figure VI-A-5.	Gas permeance (H ₂ , CO ₂) and selectivity (H ₂ /CH ₄ and CO ₂ /CH ₄) for supported graphene membranes.	108
Figure VI-A-6.	Schematic of Ti ₃ C ₂ MXene.	108
Figure VI-B-1.	Ultramicrotomed image of MOF-MMM with immiscible polymer phases. The yellow highlight shows a percolation path for gases through the MOF particles. The inset photograph shows the flexibility of the membrane.	110
Figure VI-C-1.	Robeson plot of (a) propylene/propane and (b) ethylene/ethane for Ag-X zeolite membranes (☆) compared to literature results for membranes made from carbon molecular sieve (o), ZIF-8 (◇), silica (□), mixed matrix (△), polymer (◁) and alumina (X).	112
Figure VI-C-2.	Performance of various membrane types for propylene/propane separation.	112
Figure VI-C-3.	Performance of mobile carrier facilitated transport membranes for CO ₂ -CH ₄ separation.	113
Figure VI-D-1.	Structure of SPP-TFP-4.0. The ionomer has a sulfonic acid density of 4.0 mmol/g. .	114

Figure VI-D-2.	Triblock copolymer structure prepared by Allushi et al.	116
Figure VI-D-3.	Structure of terphenyl copolymer prepared by Song. Ar ₁ represents m-terphenyl polymer units, Ar ₂ represents p-terphenyl polymer units.	117
Figure VI-D-4.	Comparison of durability and current density in a 1M KOH AEM water electrolyzer for terphenyl copolymer membrane (red star) vs other membranes.	118
Figure VI-D-5.	Schematic of a vanadium redox flow battery.	118
Figure VI-E-1.	(a) Comparison of NH ₃ conversion with Ru catalyst in a packed bed reactor (X) with Ru and CsRu catalysts in a catalytic membrane reactor. Solid lines represent computed modelled performance. (b) Equilibrium conversion as a function of temperature.	120
Figure VI-G-1.	ML deployment model for membrane discovery.	124
Figure VI-G-2.	Model for high-throughput computer screening of MOF-based membranes.	124
Figure VI-G-3.	Simulated, ML-predicted, and experimentally determined gas permeabilities for (a) MOF membranes and (b) MOF/polymer mixed-matrix membranes.	125
Figure VII-A-1.	Skid-mounted AEM electrolyzer stack capable of up to 480kW of hydrogen production.	137
Figure VII-C-1.	Cumulative clean hydrogen supply proposed by developers as of 2023.	140

TABLES

Table II-A-1.	Overall market for membranes, 2022-2027, \$MM.....	10
Table II-A-2.	Gas separation membrane module market, \$MM.....	10
Table II-A-3.	Liquid separation membrane module market, \$MM.....	10
Table II-A-4.	Membrane market for hydrogen fuel cells and water electrolyzers, by type, \$MM....	11
Table III-A-1.	Gas separation membrane module market, \$MM.....	19
Table III-A-2.	Liquid separation membrane module market, \$MM.....	19
Table III-B-1.	Membrane suppliers for gas and liquid separation applications.....	21
Table III-B-2.	Key membrane suppliers & developers, energy applications.	22
Table III-C-1.	Membrane market for hydrogen fuel cells and water electrolyzers, by type, \$MM....	23
Table III-D-1.	Emerging membrane markets (\$US) 2022-2028/2030	24
Table IV-B-1.	Top 10 chemicals with potential to be made from biomass feedstocks.	49
Table V-C-1.	EU-funded membrane reactor projects.....	71
Table V-I-1.	Representation scale of markets for emerging technologies using membranes (\$US), 2022-2028/2030.	98
Table VI-A-1.	Representative methods for tuning carbon membrane structure and performance.	105

Table VI-D-1.	Properties of commercially available anion exchange membranes.....	115
Table VI-F-1.	Membrane materials and configurations for membrane contactor pilots.....	122
Table VI-G-1.	Characteristics and typical tasks of general ML techniques.	123
Table VI-G-2.	Publicly available machine learning tools and databases for molecules and solids relevant to membrane science.	127



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