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Chemicals

Process Chemicals Workshop

Business Opportunities

14th January 2025

Process Chemicals workshop

Catalyzing Supply Chains

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iktva Program Overview (1/2)

The In-Kingdom Total Value Add (iktva) program is designed to drive increased investment, economic diversification, job creation, and workforce development within the Kingdom

Saudi Aramco aims to achieve 70% localization of all spending

iktva in Procurement

- 2000+ Service contracts
- 290+ Corporate purchase agreements

Business Opportunities

- 12 Sectors
- 210 Business Opportunities
- $28 bn Annual Market Size

Anchor Projects

6 Anchor projects

- IMI
- SPARK
- Tuwaiq

Local Workforce Development

- 16 National training centers
- 90+ Programs

Catalyzing Supply Chains

Note: IMI = International Maritime Industries; SPARK = King Salman Energy Park

iktva Program Overview (2/2)

Non-exhaustive

iktva Business Development Team Support	Government/Semi-government key enablers
Market Analysis	Financial Support
Technical Engagement	Fiscal Incentives
Operational Support and Advisory Services[1]	Land Solutions
	HR Development
	Regulatory Enablers

1. Includes broad range of support services provided by the team: user requirements, advisory on available financial and fiscal incentives, guidance on localization process in line with local regulations and standards, action plan development etc.

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Why invest in KSA?

Non-exhaustive

Strong GDP growth and healthy economy	Big market and game-changing opportunities	Government incentives and enablers	Ease of doing business	Strategic global location	Favorable demographics
Top 20 economies globally	**5** Special Economic Zones drive innovation	**$1.3T+** invested in private sector by 2030	one of world's most rewarding tax systems	**12-15%** of global trade passes via Red Sea	**17%** population growth from 2013-2023
GDP growth among highest projected in 2025 in top economies	**6** giga projects driving urbanization and industry	**5.7%** contribution of FDI to GDP by 2030	**Top 5** in the MENA region for ease of doing business	KSA container ports are among the most efficient globally	**67%** of population below the age of 35

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Note: FDI = Foreign Direct Investment
Source: IMF; MISA; Vision 2030 Key Performance Indicators; Shareek Program; World Bank

Non-exhaustive

3 Industrial Zones and Economic Cities

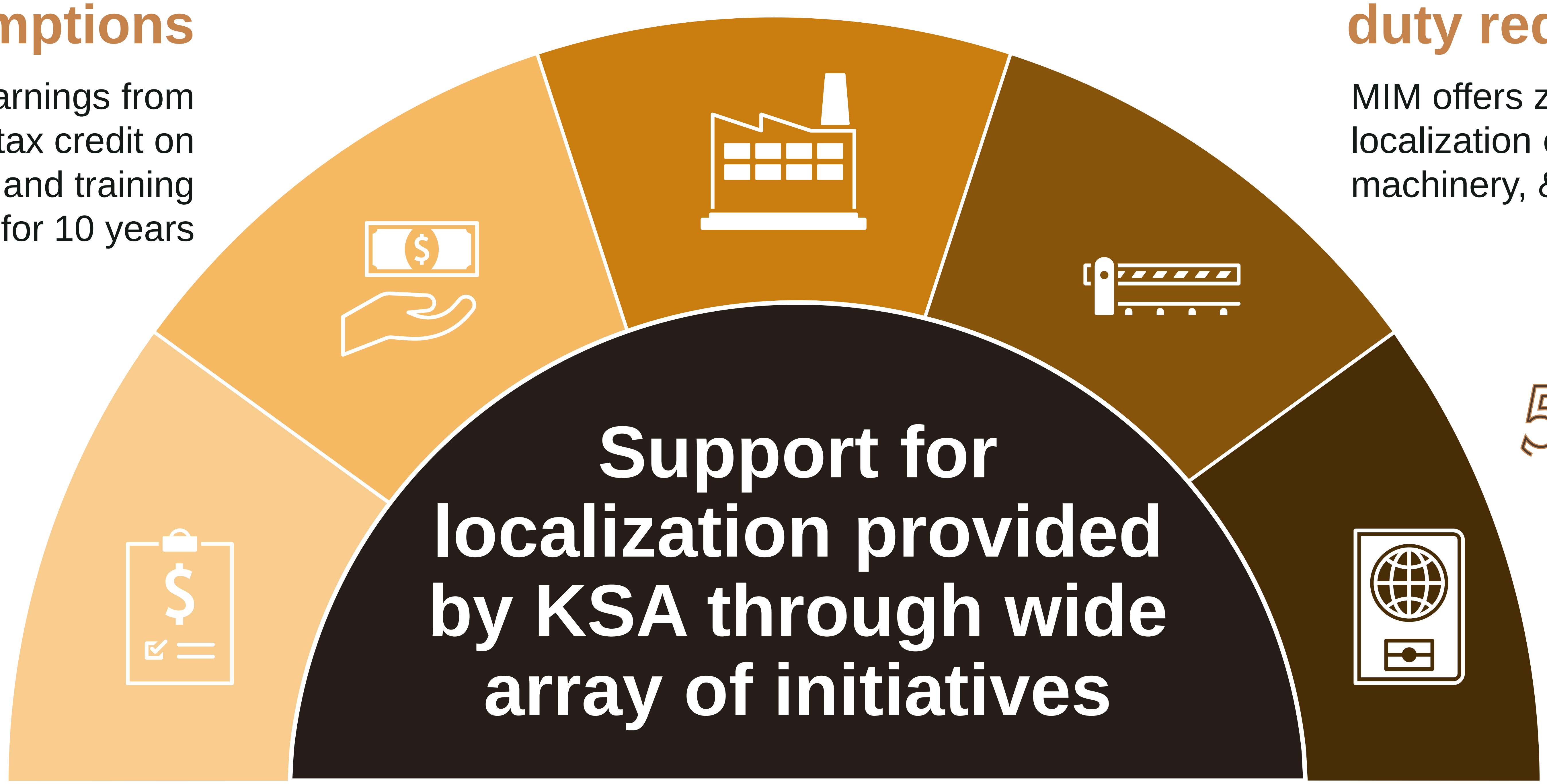
Industrial zones like Plaschem Park and Jubail Industrial City provide specialized infrastructure and logistical services essential for chemical manufacturing

2 Tax incentives and exemptions

Tax exemptions for earnings from exports and up to 50% tax credit on Saudi nationals' payroll and training costs for 10 years

4 Customs and import duty reductions

MIM offers zero import duties for localization of selected raw materials, machinery, & equipment



1 Subsidies and financial programs

Loans financing up to 75% of the industrial project provided by SIDF to foster industrial development

5 Visa and legal support

Streamlined visas for investors and skilled workers, with legal support via MISA for fast business setup and compliance

Note: SIDF - Saudi Industrial Development Fund; MIM: Ministry of Industry and Mineral Resources; MISA = Ministry of Investment Saudi Arabia
Source: SIDF; ZATCA; SPARK, MoCI; MISA

Non-exhaustive

Four key drivers for the KSA process chemicals market

Consumer industry trends

- Growing demand and investments in petrochemical conversion (e.g., SABIC, SIPCHEM) and water treatment (e.g., 8% CAGR growth in wastewater treatment) sectors within the Kingdom to realize Vision 2030 expecting to drive significant demand growth for process chemicals

Technological advancements

- Advancements in technology are enabling a sustainable future in chemical manufacturing, with innovations like catalyst technologies allowing more energy-efficient processes

Sustainability and environmental regulations

- Kingdom's sustainability initiatives aim to make core industries more responsible and compliant (e.g., Saudi Environmental Standards), driving growth in sustainable process chemicals

Economic factors

- Ambition of the Kingdom to increase value beyond oil exports by tapping into O&G opportunity conversions domestically, including megaprojects such as the Amiral complex

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Source: Gulf Petrochemicals and Chemicals Association, KROHNE Group, US Energy Information Administration (EIA), Saudi Press Authority, Industrial Centre, Riyad Capital, GMI Research, Argaam

Process chemicals demand supported by current and future megaprojects

Non-exhaustive

Sadara

Performance plastics & chemicals in 26 manufacturing plants with a capacity of over 3 MM tons per year

Existing

Amiral

New production complex with a 1,650 M tons per annum capacity of ethylene and other industrial gases

Under development

Crude Oil-to-Chemicals

Expected to produce about 9 MM tons of petrochemicals per year, converting 400,000 barrels per day of oil into chemicals

Under development

Carbon Capture & utilization Plant

A mega plant by SABIC that captures 500 M tons of CO2 per year by producing ethylene glycol and converting it into feedstock

Existing

SIPCHEM blue ammonia plant

SIPCHEM partnership with Linde expected to produce 1.3 MM tons of blue ammonia in KSA

Under development

How do we define what is an opportunity?

1

Growing market

High growth high spend markets

2

Limited local players & import driven

Markets with few local contributors and high import resilience

3

Technological & labor feasibility

Markets with accessible or standardized technology and available skilled labor

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Process Chemicals Market Overview

KSA process chemicals

$1.3 B

5% CAGR[1]

2024 KSA market size for opportunities in today's workshop

10 opportunities to be discussed today

1	Process catalysts
2	Antifreeze
3	Solid desiccant
4	Methyl diethanolamine
5	Polytetrafluoroethylene
6	Alpha olefins
7	Masterbatch
8	Adipic Acid
9	CO2 removal agents
10	CCS additives

Catalyzing Supply Chains

1. 5-year forecasted KSA CAGR (2024-2029)

Process Catalysts

Business Opportunity

Opportunity profile

1
Process catalysts are critical to realize KSA's industrial diversification strategy and ongoing O&G expansion

Type(s)	
Ceramic balls	Specific gravity: 2.5 - 3.5
Titanium dioxide	Specific gravity: 3.9 - 4.2
Non-precious metals	Specific gravity: 5 - 9
Superclause selective	Specific gravity: 3.5 - 4.5
Precious metals	Specific gravity: 10 - 22
Selective oxidation	Specific gravity: 3 - 5

Catalyzing Supply Chains

2
Process catalyst market is sizeable and expected to remain stable

$644 MM Estimated 2024 KSA market size

5% Forecasted 5-year CAGR

3
Attractive investment opportunities exist within the value chain

KSA value chain opportunities

Product formulation

Source: S&P global commodity insights, Saudi Aramco analysis, Team analysis

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Technical overview

PROCESS CATALYSTS

Catalyst: Ceramic balls[1]	Catalyst: Precious metals[2]	Catalyst: Non-precious metals[3]	Catalyst: Titanium dioxide[4]	Selective oxide-tion catalyst[5]	Superclaus selective catalyst[6]
Specific Gravity: 2.5 – 3.5	Specific Gravity: 10-22	Specific Gravity: 5-9	Specific Gravity: 3.9 – 4.2	Specific Gravity: 3 – 5	Specific Gravity: 3.5 – 4.5
Form: Spherical with a mixture of alumina and inert ceramics	Form: Powder, pellets, or supported on substrate	Form: Powder or pellet form	Form: Cylindrical extrudates used as claus catalyst	Form: Mixture of primarily silicon dioxide and aluminum oxide	Form: Mixture of activated silica and inert alumina in 25%-75% volume

Oil & Gas applications

- Petroleum refining
- Gas processing

Other applications

- Petrochemical processing
- Synthesis of polymer

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1. Aramco material number 6000001767 2. Aramco material number 6000001812 3. Aramco material number 6000001716 4. Aramco material number 1000775823 5. Aramco material number 1001058453 6. Aramco material number 1000878234

Source: Expert interviews, Saudi Aramco analysis, team analysis

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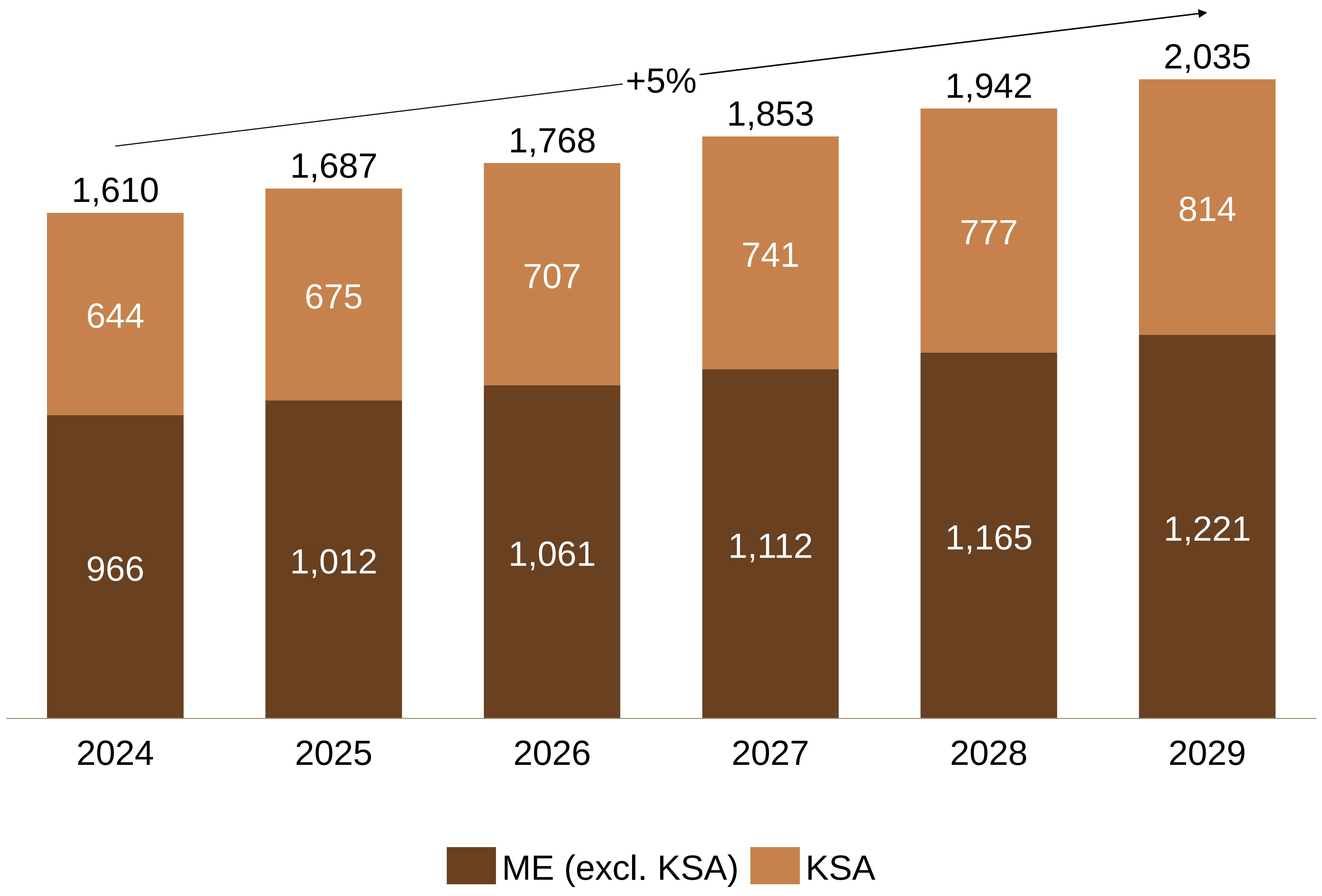
Process catalyst demand, customers, and drivers

Forecasted Middle East process catalyst market 2024-2029 ($MM)



Typical customers in KSA

- Oil & Gas players
- Petrochemical manufacturers

Key KSA demand drivers

- Consumer industry demand: Expansion plans of KSA's O&G sector leads to steady need for petroleum refining catalysts
- Economic factors: Industrial diversification and increased production of polymer and chemical MFE driving growth for chemical processing catalysts

Catalyzing Supply Chains

Notes: MFE = Manufacturing
Source: S&P global commodity insights, expert interviews, team analysis

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Value chain and key localization opportunities

	Raw materials	Product formulation
Local saturation	Multiple players	Few players
Current value chain	• Silica, alumina, titanium dioxide are locally available • PGMs imported with steady supply available for local consumption	• Opportunity to localize manufacturing of process catalysts[1] Opportunity
Success factors		
Technology		• Catalyst solutions and IP for oil to chemical from leading players
Labor		• Chemical engineers with expertise in catalyst formulation and quality control

Process Chemicals workshop

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1. Presence of limited player for certain catalysts such as hydrotreating, three upcoming plants for chemical processing announced
Note: PGM = Platinum grade metals
Source: Expert interviews, team analysis

Antifreeze

Business Opportunity

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Opportunity profile

1

Antifreeze is a critical component to realize the ongoing KSA industrial diversification strategy

Type(s)

Triethylene glycol	Specific gravity: 1.1
Monoethylene glycol	Specific gravity: 1.1

2

Antifreeze market in the region projected to show steady growth

$27 MM Estimated 2024 KSA market size

3% Forecasted 5-year CAGR

3

Attractive investment opportunities exist within the value chain

KSA value chain opportunities

Product formulation

Process Chemicals workshop

Catalyzing Supply Chains

Source: S&P global commodity insights, Saudi Aramco analysis, team analysis

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Technical overview

Monoethylene glycol (MEG)[1]

General specifications

- Chemical formula: $C_2H_6O_2$
- Specific Gravity: 1.1
- Form: Colorless odorless liquid

Triethylene glycol (TEG)[2]

General specifications

- Chemical formula: $C_6H_{14}O_4$
- Specific Gravity: 1.1
- Form: Colorless odorless liquid

Oil & Gas applications

- Industrial coolant
- Hydraulic solutions
- Dehydrating agent in gas plants

Other applications

- Automotive engine cooling
- Refrigeration systems
- Food and beverage processing

1. Aramco material number 1000182780, 2. Aramco material number 1000187171 & 1000187178
Source: Expert interviews, Saudi Aramco analysis, team analysis

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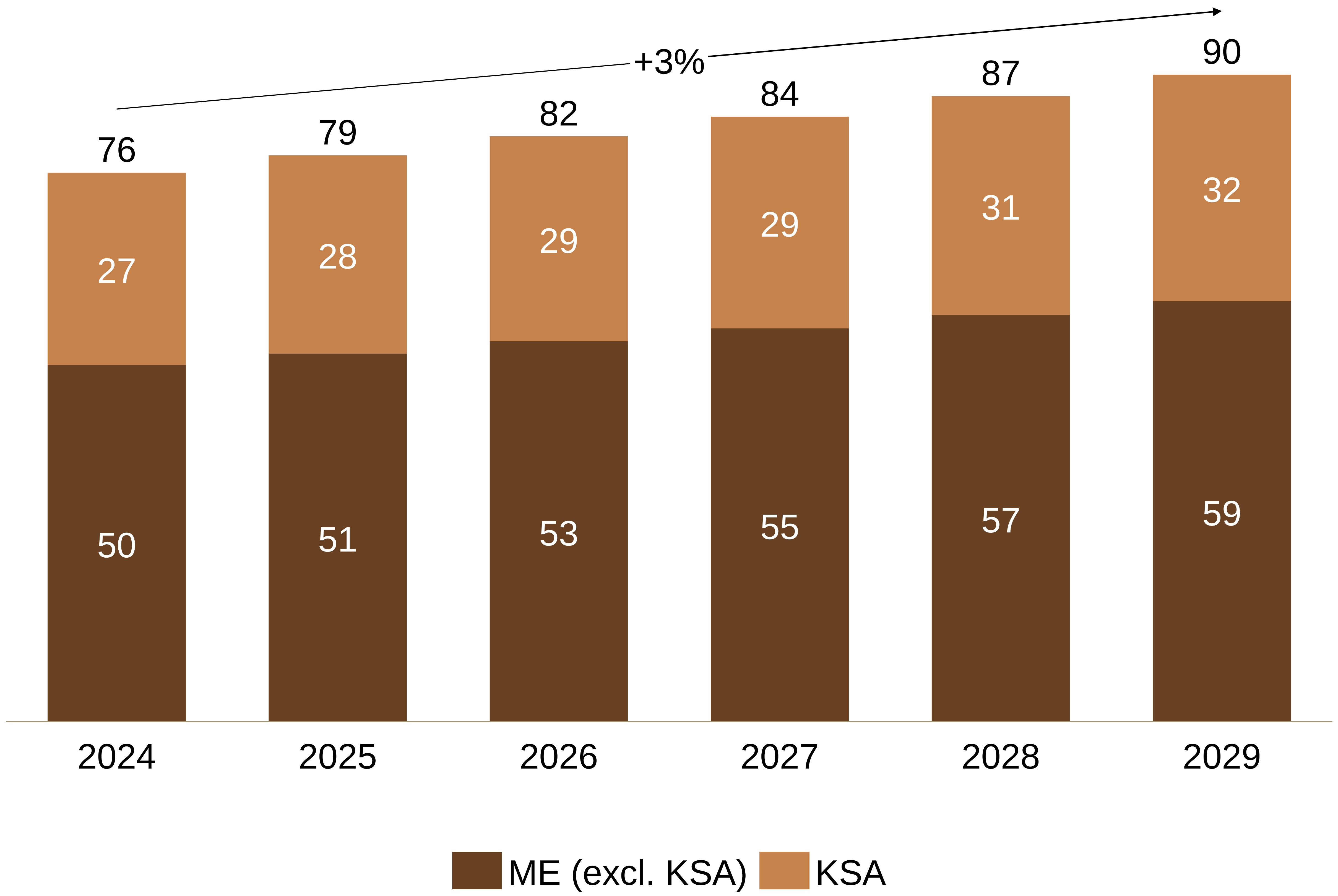
Antifreeze demand, customers, and drivers

Forecasted Middle East antifreeze market 2024-2029 ($MM)



Typical antifreeze customers in KSA

- Oil & Gas players
- Petrochemical industry
- Automotive industry[1]

Key KSA demand drivers

- Consumer industry trends: Expansion plans for gas plants and increased production in the Kingdom leading to increased need for antifreeze products
- Economic & demographic factors: Increased vehicle ownership boosting demand for engine coolants

Process Chemicals workshop

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1. Main consumers being dealerships, service centers and independent workshops for automobiles coolant (similar mixture to antifreeze with slightly composition)

Source: S&P global commodity insights, expert interviews, team analysis

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Value chain and key localization opportunities

	Raw materials	Intermediate process	Product formulation
Local saturation	Multiple players	Multiple players	Few players
Current value chain	• Ethylene Oxide, Diethylene Glycol (DEG) are locally available	• Intermediary products such as monoethylene glycol (MEG) and triethylene glycol (TEG) are locally available	• Opportunity to localize antifreeze (blended formulation of MEG / TEG with water and additives) products Opportunity

Success factors

	Raw materials	Intermediate process	Product formulation
Technology			• Advanced formulation and purification systems
Labor			• Chemical engineers & technicians specialized in glycol production

Process Chemicals workshop

Catalyzing Supply Chains

Source: Expert interviews, team analysis

Solid Desiccant

Business Opportunity

Opportunity profile

1
High need of solid desiccants in gas plants and industrial manufacturing

Type(s)	
Solid Desiccant	Specific gravity: 0.7 -2.2[1]

2
Solid desiccants are a niche market with moderate growth

$11 MM Estimated 2024 KSA market size

5% Forecasted 5-year CAGR

3
Attractive investment opportunities for investors in solid desiccant value chain

KSA value chain opportunities

Product formulation

1. Depending on the type and composition of molecular sieves, activated alumina, and silica gel
Source: Expert interviews, Saudi Aramco data, team analysis

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Technical overview

Solid Desiccant[1]

General specifications

- Key categories: Usually aluminum based, molecular sieve, activated alumina or silica gel based
- Strong physical adsorption properties
- Primarily used for removal of water from gas or liquid hydrocarbon

Oil & Gas applications

- Natural gas dehydration
- Dehydrating CO2 for EOR

Other applications

- Solvent and hydrocarbon drying
- Compressed air drying
- Humidity control for electronics packaging
- Protection for moisture sensitive catalysts
- Pharmaceutical product storage

1. Aramco material numbers 6000001790

Note: Enhanced Oil Recovery

Source: Expert interviews, team analysis

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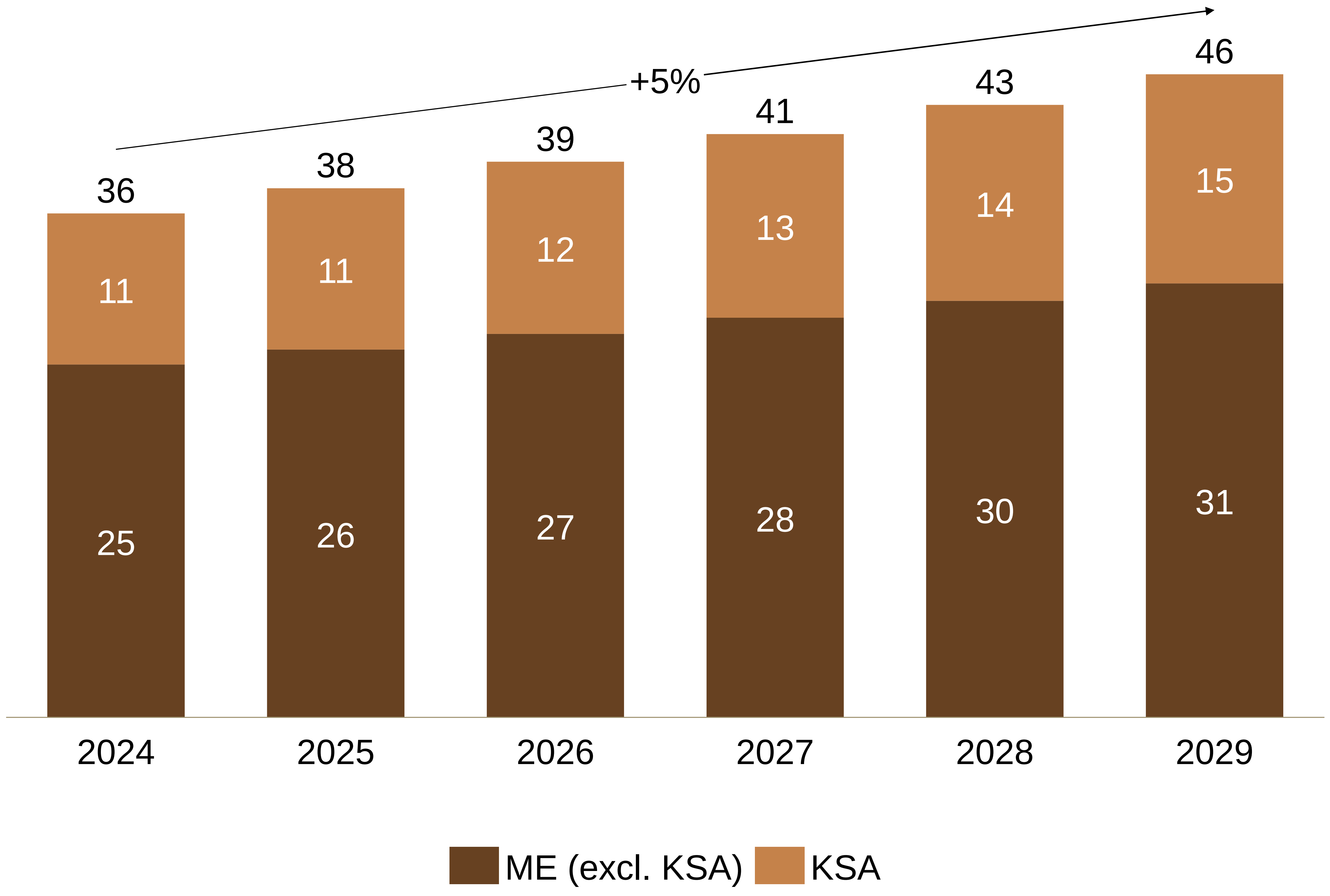
Solid desiccant demand, customers, and drivers

Forecasted Middle East solid desiccant market 2024-2029 ($MM)



Typical customers in KSA

- Oil & Gas players
- Industrial manufacturers
- Pharmaceutical industry

Key KSA demand drivers

- Industry demand: Expansion of O&G operations drive demand for solid desiccants as they are necessary for gas dehydrating solutions
- Economic drivers: Growth in non-oil sectors leads to demand increase in desiccants as a dehydrating agent and protection against moisture

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Source: Expert interviews, Saudi Aramco data, Team analysis

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Value chain and key localization opportunities

	Raw materials	Intermediate process	Product formulation
Local saturation	Multiple players	Multiple players	Few players
Current value chain	• Raw materials such as alumina and silica available locally	• Intermediary products such as sodium silicate locally available	• Opportunity to localize production of solid desiccants Opportunity
Success factors			
Technology			• Calcination / activation furnaces and tech for sol-gel processing
Labor			• Material scientists and furnace production technicians

Process Chemicals workshop

Catalyzing Supply Chains

Source: Expert interviews, team analysis

Methyldiethanolamine (MDEA)

Business Opportunity

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Opportunity profile

1

MDEA's are critical to realize ongoing gas plant expansion and sustainability plans

Type(s)

Methyl diethanolamine	Specific gravity: 1.04-1.041

2

MDEA market is expected to show moderate growth in the next 5 years

$60 MM Estimated 2024 KSA market size

6% Forecasted 5-year CAGR

3

Attractive investment opportunities for investors in MDEA value chain

KSA value chain opportunities

- Intermediate process
- Product formulation

Source: 24marketresearch, expert interviews, Saudi Aramco data, team analysis

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Technical overview

Methyldiethanolamine[1]

General specifications

- Chemical formula: $C_5H_{13}NO_2$
- Specific Gravity: 1.04 – 1.041
- Form: Colorless to pale yellow liquid

Oil & Gas applications

- Gas sweetening agent
- Amine blends for improved absorption

Other applications

- Removal of H2S in petrochemical plants
- CO2 removal in CCUS
- Acidic gas removal from wastewater

1. Aramco material numbers 1000959459 and 1001032210
Source: Expert interviews, Saudi Aramco analysis , team analysis

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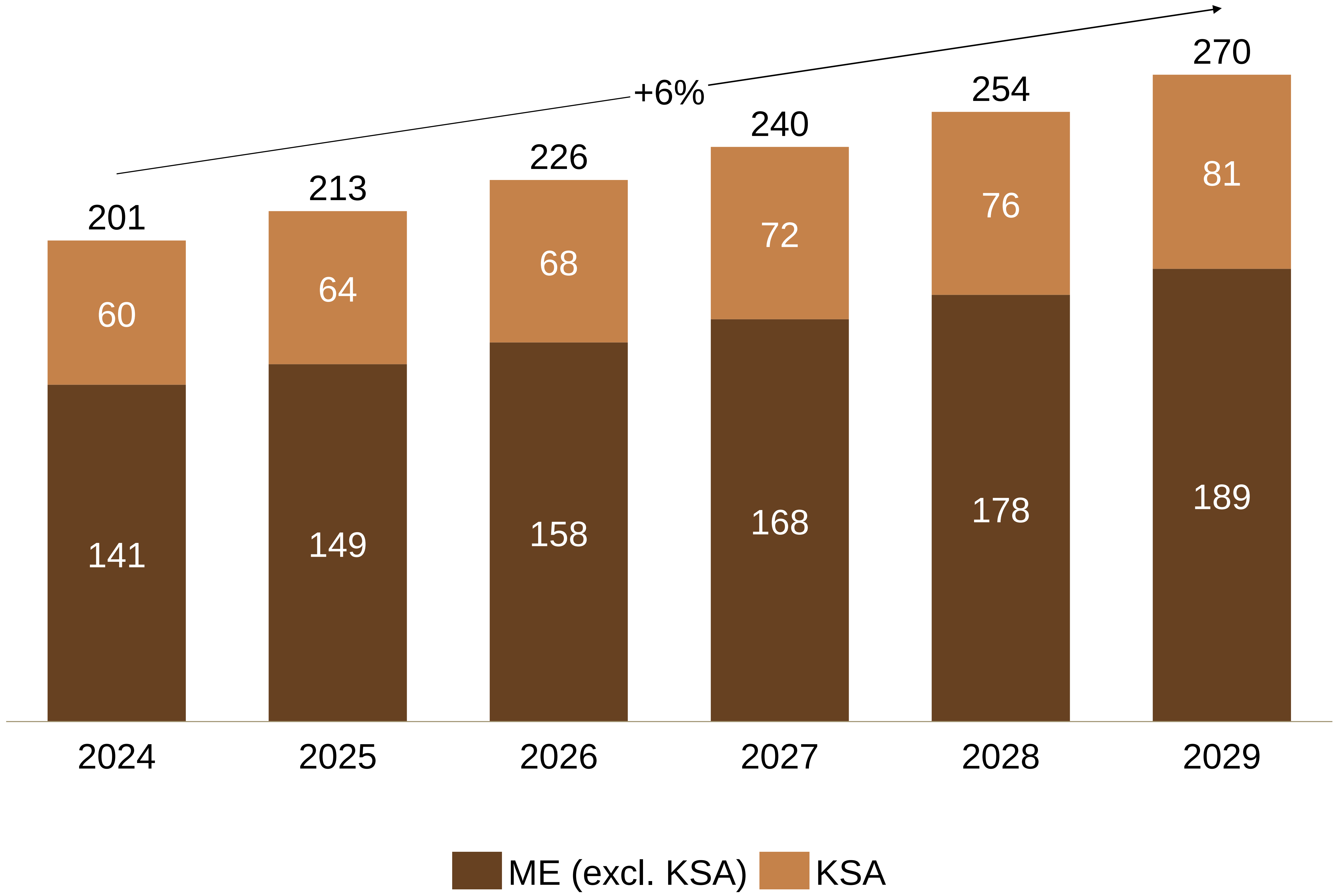
Methyldiethanolamine (MDEA) demand, customers, and drivers

Forecasted Middle East MDEA market 2024-2029 ($MM)



Typical customers in KSA

- Oil & Gas players
- Petrochemical manufacturers
- Industrial manufacturers

Key KSA demand drivers

- Consumer Industry growth: Growing production for gas leading to an increased need for MDEA as a gas sweetening agent
- Sustainability and economic factors: Growth in CCUS technology as part of Vision 2030 leading to an increase in MDEA demand as an agent for CO2 absorption

Process Chemicals workshop

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Notes: CCUS: Carbon capture utilization and storage
Source: Expert interviews, Saudi Aramco data, team analysis

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Value chain and key localization opportunities

	Raw materials	Intermediate process	Product formulation
Local saturation	Multiple players	Few players	No players
Current value chain	• Methanol, ammonia, and formaldehydes available locally	• Opportunity to localize the production of intermediary products such as methylamines Opportunity	• Opportunity to localize MDEA production Opportunity

Success factors

Technology		• Methylamine production IP and advanced machinery	
Labor		• Engineers with expertise in optimizing chemical processes	• Chemical engineers with expertise in catalyst formulation

Process Chemicals workshop

Catalyzing Supply Chains

Source: Expert interviews, team analysis

Polytetrafluoroethylene (PTFE)

Business Opportunity

Opportunity profile

1

KSA needing PTFE for growing industrial manufacturing, automotive and petrochemical industries

Type(s)

- Polytetrafluoroethylene: Dispersion
- Polytetrafluoroethylene: Fine powder
- Polytetrafluoroethylene: Granular

2

PTFE market is forecasted to show steady growth in the next 5 years

$6 MM Estimated 2024 KSA market size

3% Forecasted 5-year CAGR

3

Attractive investment opportunities exist within the value chain

KSA value chain opportunities

- Raw material
- Intermediate process
- Product formulation

Process Chemicals workshop

Catalyzing Supply Chains

Notes: PTFE = Polytetrafluoroethylene
Source: Expert interviews; Team analysis

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Technical overview

Polytetrafluoroethylene: Dispersion

General specifications

- Chemical formula: $(C_2F_4)_n$
- Specific gravity: 1.5 – 1.55

Polytetrafluoroethylene: Fine powder

General specifications

- Chemical formula: $(C_2F_4)_n$
- Specific gravity: 2.15 – 2.20

Polytetrafluoroethylene: Granular

General specifications

- Chemical formula: $(C_2F_4)_n$
- Specific gravity: 2.13 - 2.16

Oil & Gas applications

- Additive in drilling fluid
- Seals and gaskets in pipelines
- Valve components
- Pads, bearings, and bushings

Other applications

- Coatings and insulation
- Automotive hoses
- High performance wires and cables

Source: Expert interviews, Saudi Aramco analysis, team analysis

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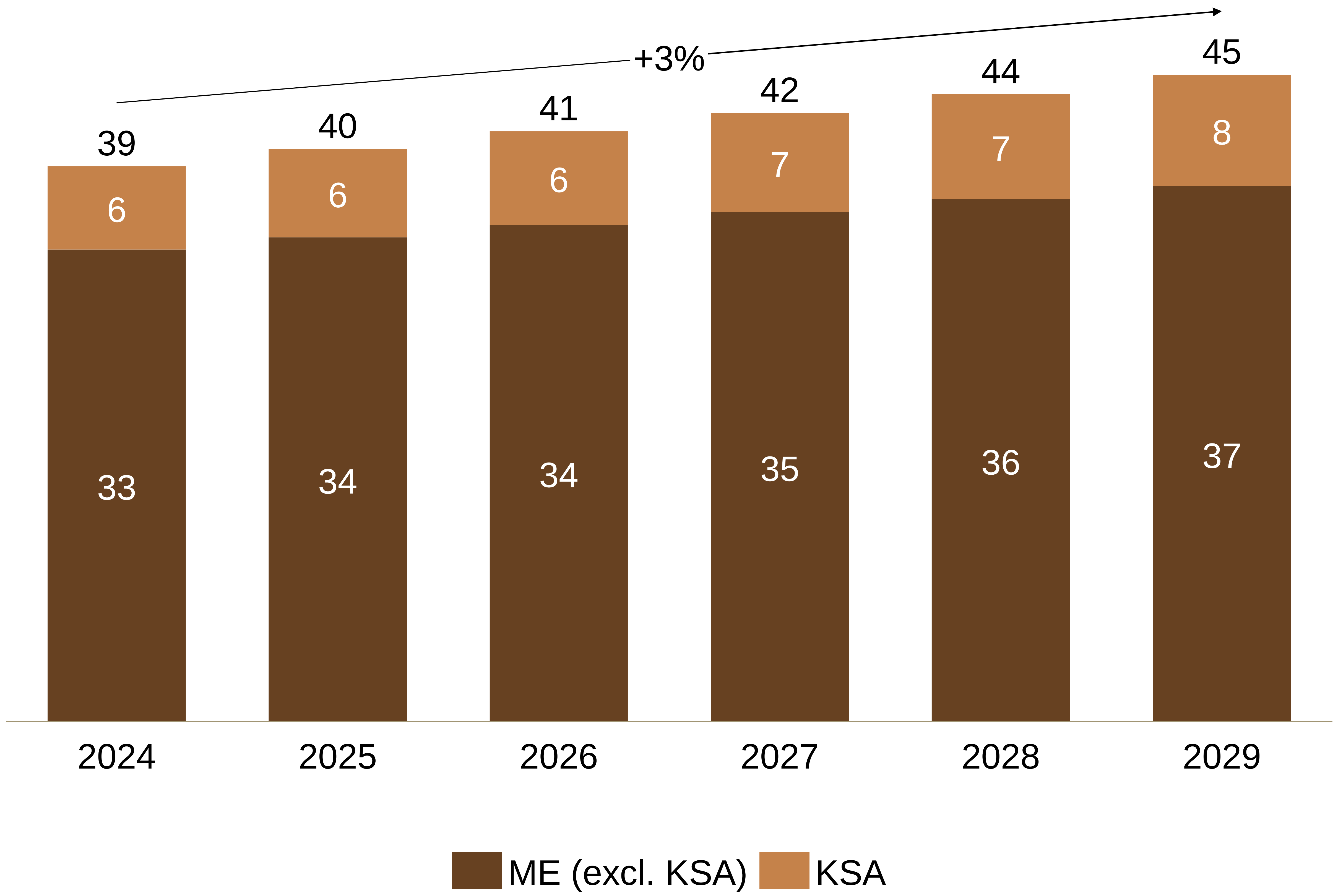
Polytetrafluoroethylene demand, customers, and drivers

Forecasted Middle East PTFE market 2024-2029 ($MM)



Typical customers in KSA

- Oil & Gas players
- Petrochemical manufacturers
- Industrial manufacturing

Key KSA demand drivers

- Consumer demand: Rise in upstream activities leading to increase in demand for PTFE used as valve sealants, pipe coatings by suppliers and drilling fluid additive
- Economic factors: Industrial diversification and increased production of polymer and chemical MFE driving growth for chemical processing catalysts

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MFE = manufacturing

Note: Middle East includes Turkey

Source: S&P global commodity insights, expert interviews, team analysis

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Value chain and key localization opportunities

	Raw materials	Intermediate process	Product formulation
Local saturation	Mixed players	No players	No players
Current value chain	• Sulfuric acid available locally • Opportunity to localize production of chloroform, and fluorspar Opportunity	• Opportunity to localize production of tetrafluoroethylene Opportunity	• Opportunity to localize production of polytetrafluoroethylene (PTFE) in KSA Opportunity
Success factors			
Technology	• Advanced chlorination reactors and purification systems	• Technology for thermal cracking	• Advanced gas separation and purification systems
Labor	• Trained engineers in chemical process optimization	• Engineers with expertise in fluoropolymer chemistry	• Technicians with expertise in quality control and testing

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Source: Mordor Intelligence, expert interviews, team analysis

Alpha olefins

Business Opportunity

Opportunity profile

1
Growing need for alpha olefins to meet growing O&G expansion and industrial diversification

Type(s)

Alpha olefins	Specific gravity: 0.6 – 0.8

2
Alpha olefin market expected to show steady growth

$269 MM — Estimated 2024 KSA market size

3% — Forecasted 5-year CAGR

3
Attractive investment opportunities exist within the value chain

KSA value chain opportunities

Product formulation

Source: S&P global commodity insights; Expert interviews; Team analysis

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Technical overview

Alpha olefins

General specifications

- Key categories: Isomerized olefins and higher alpha olefins[1]
- Chemical formula: C_nH_{2n}
- Specific gravity: 0.6 – 0.8
- Immiscible with water

Oil & Gas applications

- Formulation base for oilfield chemicals
- Corrosion inhibitors for pipelines[1]

Other applications

- Comonomer used for polyethylene production
- Used to produce synthetic lubricants
- Utilized to produce bio-plastics[2]

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1. Poly alpha olefins, 2. Varies based on the LTS of non-metallic pipelines
Source: Expert interviews, team analysis

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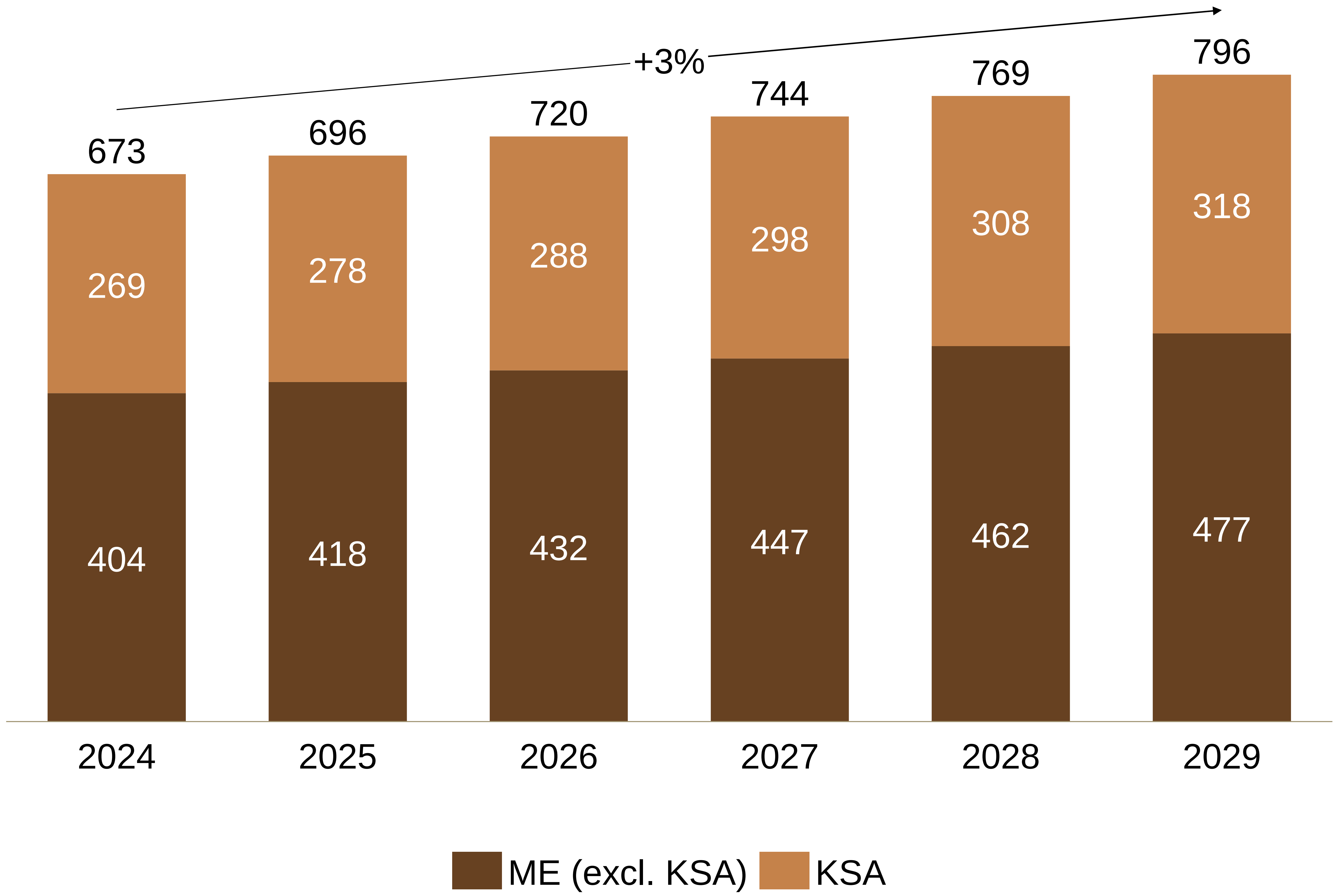
Alpha olefins demand, customers, and drivers

Forecasted Middle East alpha olefins market 2024-2029 ($MM)



Typical end-product customers in KSA

- Oil & Gas players
- Petrochemical manufacturers
- Industrial manufacturing

Key KSA demand drivers

- Consumer industry demand: Rise in upstream activities leading to increased demand for alpha olefins used as raw materials for oilfield chemicals
- Economic factors: Industrial diversification and increased production of polymer and chemical MFE driving growth for alpha olefins used as raw material

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Notes: MFE = Manufacturing
Source: S&P global commodity insights, expert interviews, team analysis

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Value chain and key localization opportunities

	Raw materials	Product formulation
Local saturation	Multiple players	Few players[1]
Current value chain	• Raw materials such as ethylene, sodium hydroxide locally available	• Opportunity to localize production of alpha olefins in KSA Opportunity
Success factors		
Technology		• Advanced oligomerization technology
Labor		• Skilled chemical engineers for optimizing chemical processes

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1. Announcement for production plant by INEOS in the Amiral project
2. Source: Expert interviews, team analysis

Masterbatch

Business Opportunity

Opportunity profile

1

Growing demand for masterbatch as a result of industrial diversification strategy and increased manufacturing

Type(s)

Master-batch	Specific gravity: 1.1 – 2

2

Masterbatch is expected to show strong growth over the next 5 years

$108 MM — Estimated 2024 KSA market size

9% — Forecasted 5-year CAGR

3

Attractive investment opportunities exist within the value chain

KSA value chain opportunities

Product formulation

Source: S&P global commodity insights, Saudi Aramco analysis, Team analysis

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Technical overview

Masterbatch

General specifications

- Key categories: White, black, color, additive, filler
- Specific gravity: 1.1 – 2

Oil & Gas applications

- Flexible pipelines
- Cable insulation and sheathing
- Tank and vessel linings
- Protective films

Other applications

- Polymer processing for industrial packaging, automobile components, insulation products
- Colorant for plastics

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Source: Expert interviews, team analysis

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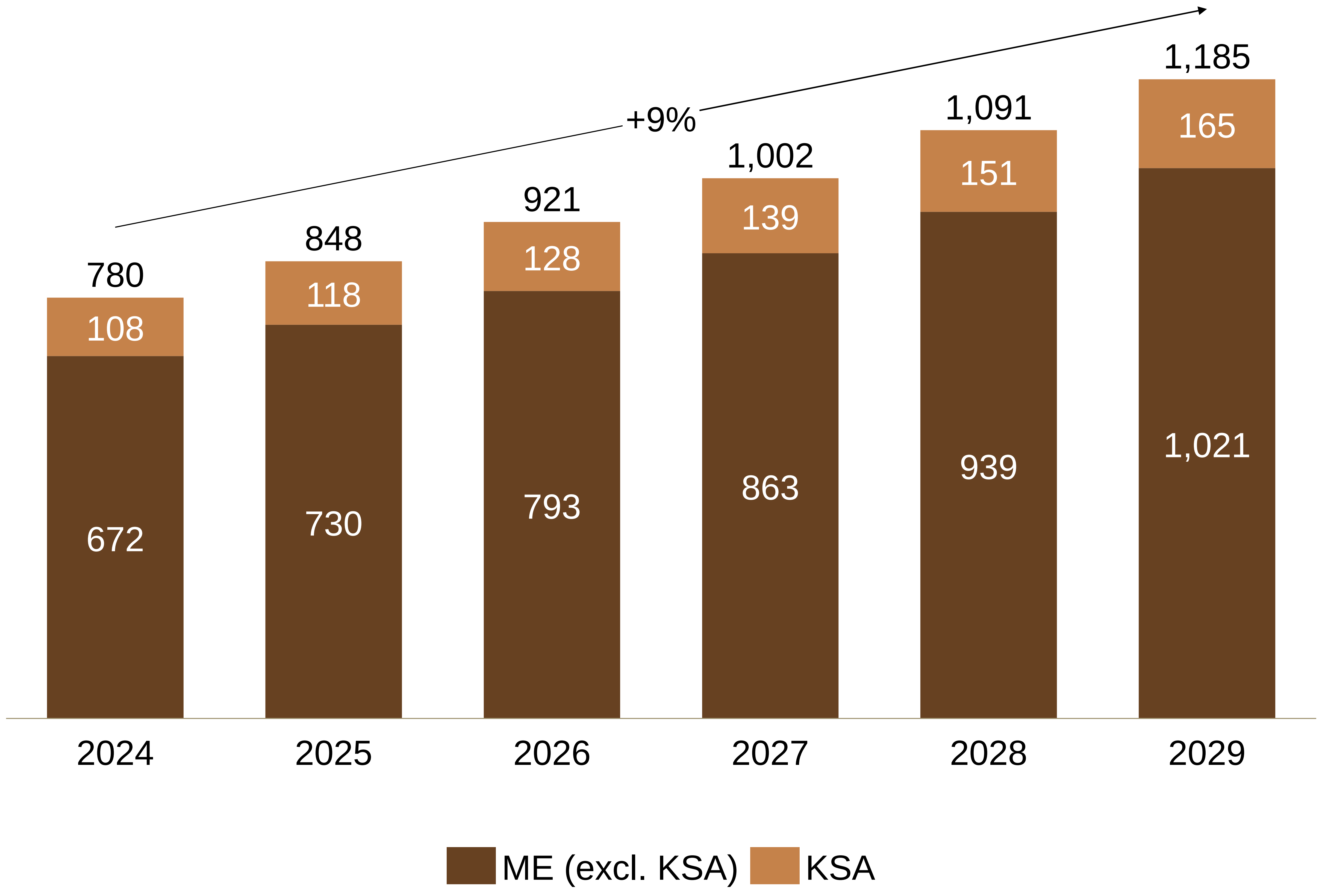
Masterbatch demand, customers, and drivers

Forecasted Middle East masterbatch market 2024-2029 ($MM)



Typical customers in KSA

- Oil & gas players
- Petrochemical manufacturers
- Industrial manufacturers

Key KSA demand drivers

- Consumer industry demand: Increased capital expenditure in offshore projects to maintain 12 million bpd of production capacity leading to increase in materials such as flexible pipelines which uses masterbatch as raw material
- Economic factors: Industrial diversification and increased production of industrial MFE driving growth for masterbatch used as raw material

Catalyzing Supply Chains

Source: S&P global commodity insights, expert interviews, team analysis

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Value chain and key localization opportunities

	Raw materials	Product formulation
Local saturation	Multiple players	Few players
Current value chain	• Raw materials such as titanium dioxide, pigments available locally	• Opportunity to localize production of different types of masterbatch in the Kingdom Opportunity
Success factors		
Technology		• Manufacturing technology and quality control systems
Labor		• Experienced technicians for plant operations

Catalyzing Supply Chains

Source: Expert interviews, team analysis

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Adipic Acid

Business Opportunity

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Opportunity profile

1

Growing need for adipic acid as intermediary in petrochemical and industrial production

Type(s)	
Adipic acid	Specific gravity: 1.36

2

Adipic market is expected to show steady growth over the next 5 years

$176 MM Estimated 2024 KSA market size

3% Forecasted 5-year CAGR

3

Attractive investment opportunities exist within the value chain

KSA value chain opportunities

Product formulation

Catalyzing Supply Chains

Source: Mordor Intelligence, Saudi Aramco analysis, Team analysis

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Technical overview

Adipic acid

General specifications

- Chemical formula: $C_6H_{10}O_4$
- Specific gravity: 1.36
- Form: White crystalline compound

Oil & Gas applications

- Intermediary for production of corrosion inhibitors
- Production of high thermal resistance sealants

Other applications

- Production of nylon-6,6[1]
- Plasticizers, polyurethane and polyester polyol
- Intermediary for resins used in coatings
- Food additives

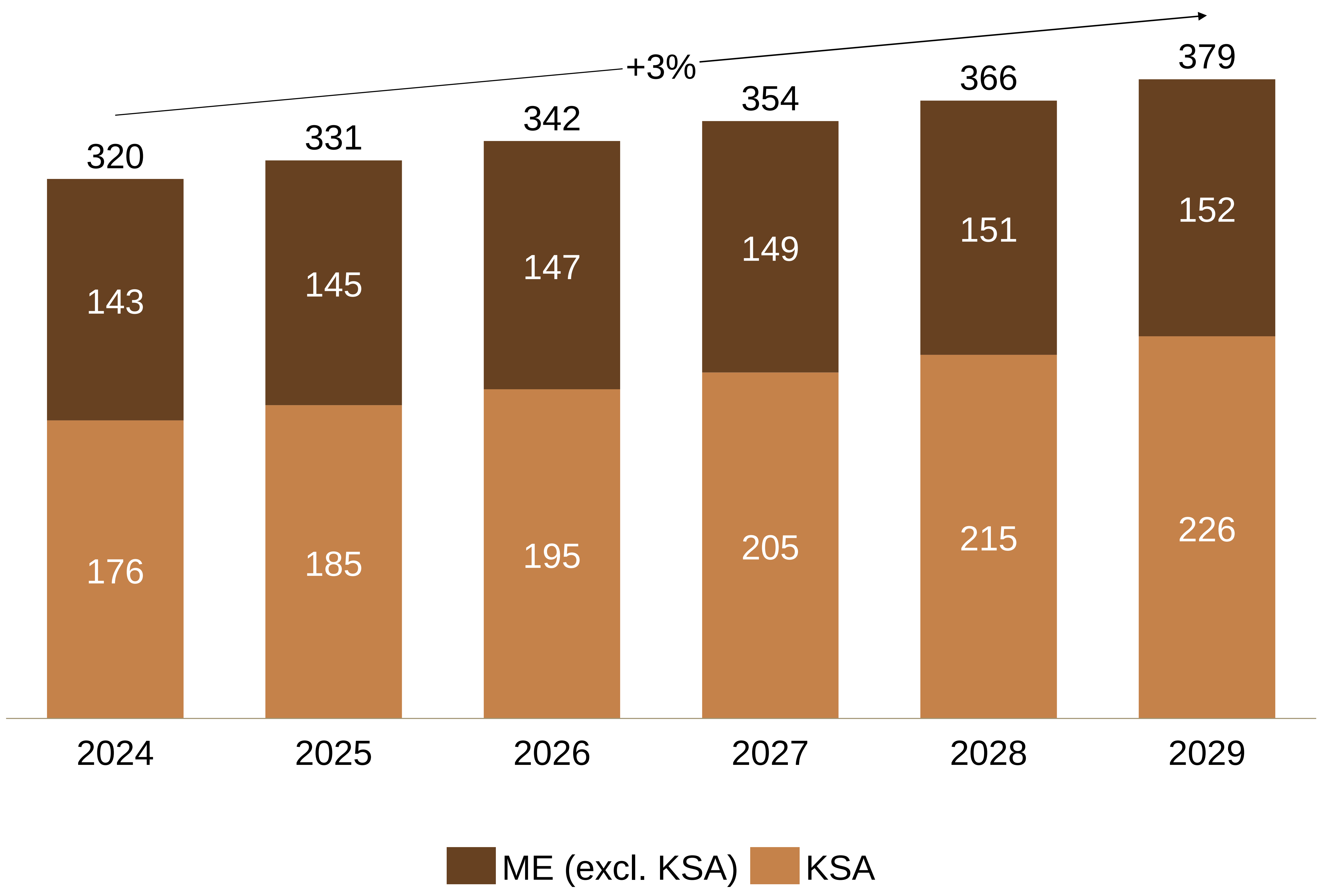
Catalyzing Supply Chains

1. Not produced in the middle east; export focused

Source: Expert interviews, team analysis

Adipic acid demand, customers, and drivers

Forecasted Middle East adipic acids market 2024-2029 ($MM)



Typical end - customers in KSA

- Oil & gas players
- Petrochemical manufacturers
- Industrial manufacturers

Key KSA demand drivers

- Consumer industry demand: Increased upstream production leading to increased demand for adipic acid used as raw materials for corrosion inhibitors and sealants
- Economic factors: Industrial diversification and increased production of polymers and chemical MFE driving growth for adipic acid as raw material

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Process Chemicals workshop

Source: Mordor Intelligence, expert interviews, team analysis

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Value chain and key localization opportunities

	Raw materials	Product formulation
Local saturation	Multiple players	Few players
Current value chain	• Raw materials such as cyclohexane and nitric acid available locally	• Opportunity to localize production of adipic acid in the Kingdom Opportunity
Success factors		
Technology		• License foreign technology and machinery for nitric acid oxidation
Labor		• Experienced technicians with knowledge on adipic acid production

Process Chemicals workshop

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1. Source: Expert interviews, team analysis

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CO_2 removal agents for CCUS

Business Opportunity

Process chemicals workshop

Catalyzing Supply Chains

Opportunity profile

1

KSA is in high need of CO_2 removal agents to meet their carbon neutrality goals as part of Vision 2030

Type(s)

CO_2 adsorbents

CO_2 absorbents

2

CO_2 removal market is niche with significant growth expected

$1 MM — Estimated 2024 KSA market size

52% — Forecasted 5-year CAGR

3

Attractive investment opportunities exist within the value chain

KSA value chain opportunities

- Intermediate process
- Product formulation

Source: S Center on Global Energy Policy Columbia, Global GCC Institute, Saudi Aramco data, team analysis

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Technical overview

CO_2 adsorbents

General specifications

- Types: Metal organic frameworks, activated carbon, amine functional materials

Applications

- Carbon capture systems
- Enhanced oil recovery
- Gas separation and purification
- Direct air capture
- Air and water purification

CO_2 absorbents

General specifications

- Types: Potassium carbonate, amino acid liquids

Applications

- Mobile carbon capture technology agent
- Enhanced oil recovery
- Feedstock purification and natural gas sweetening
- Equipment and machinery protection

Catalyzing Supply Chains

Source: Expert interviews, team analysis

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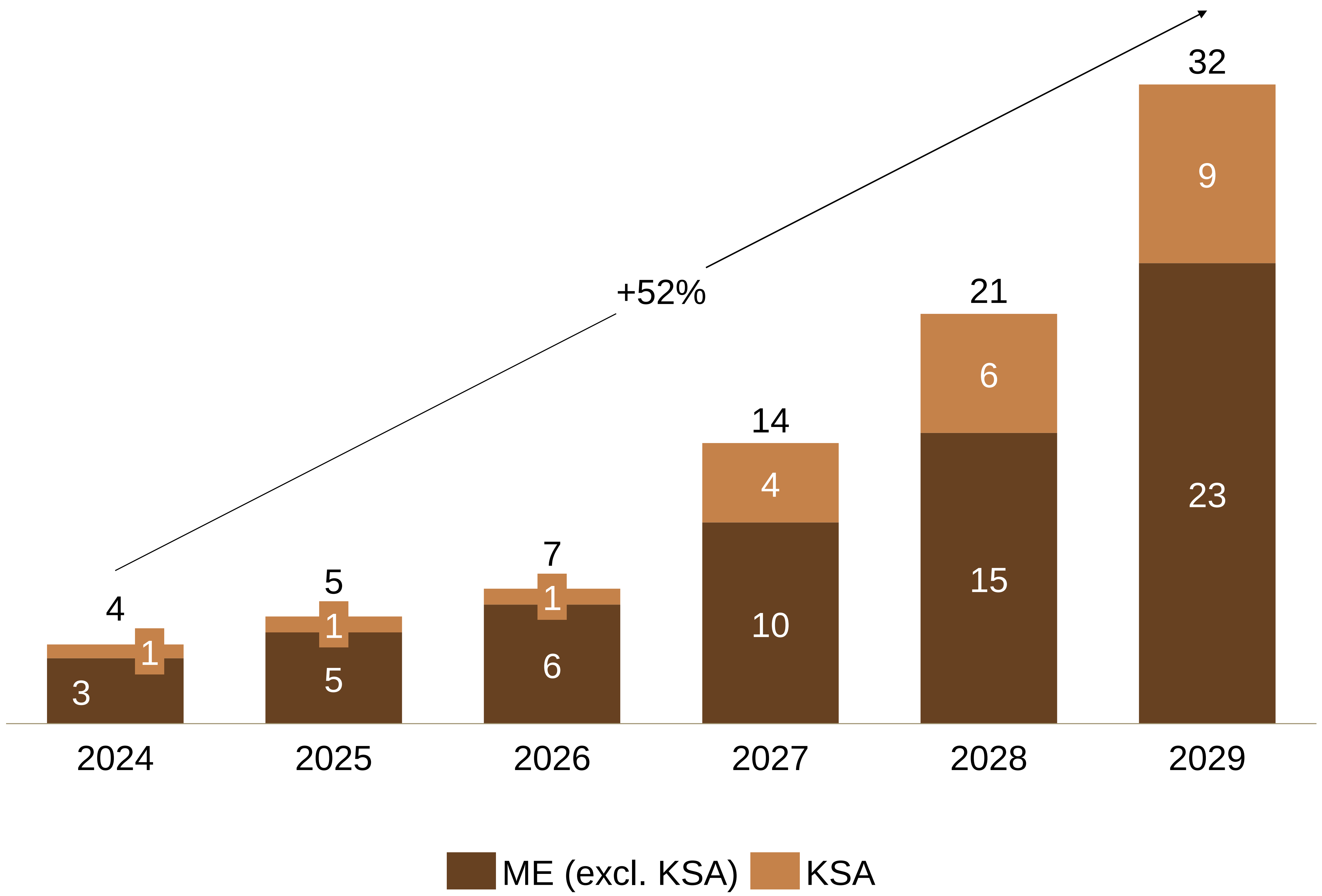
CO_2 removal agents demand, customers, and drivers

Forecasted GCC CCUS market 2024-2029 ($MM)



Typical customers in KSA

- Oil & Gas players
- Petrochemical manufacturers
- Power generation

Key KSA demand drivers

- Consumer industry demand: Long term strategy of Saudi Aramco to achieve net-zero scope 1 and 2 emissions
- Sustainability and economic factors: Growth in CCUS technology as part of national commitments towards CO2 capture

Catalyzing Supply Chains

Note: Market forecast based on the current pledges and plans for CO2 absorption and adsorption technology
Source: Center on Global Energy Policy Columbia, Global GCC Institute, expert interviews, team analysis

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Value chain and key localization opportunities

	Raw materials	Intermediate process	Product formulation
Local saturation	Multiple players	Mixed players	Few players
Current value chain	• Raw material such as potassium chloride, ammonia, silica and bauxite available locally	• Ethylene amines available locally • Opportunity to localize potassium bicarbonate /citrate and amino acids Opportunity	• Opportunity to localize production of CO2 removal agents Opportunity

Success factors

	Raw materials	Intermediate process	Product formulation
Technology		• Reaction control systems	• High throughput experimentation facilities
Labor		• Technicians with expertise in chemical processing	• Engineers with expertise in chemical formulation

Catalyzing Supply Chains

Process Chemicals workshop

Source: Expert interviews, team analysis

CCS additives

Business Opportunity

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Technical overview

CCS additives

General specifications

- Key categories: Specialty corrosion inhibitors, solvent stabilizers

CCS applications

- Enhance solvent shelf life
- Corrosion prevention from acidic by-products
- Foaming control for solvents

Other applications

- Pipeline and refinery equipment protection
- Stabilizers for polymer production
- Improves viscosity in paints and coatings

Notes: CCS = Carbon capture and storage
Source: Expert interviews, Saudi Aramco analysis, team analysis

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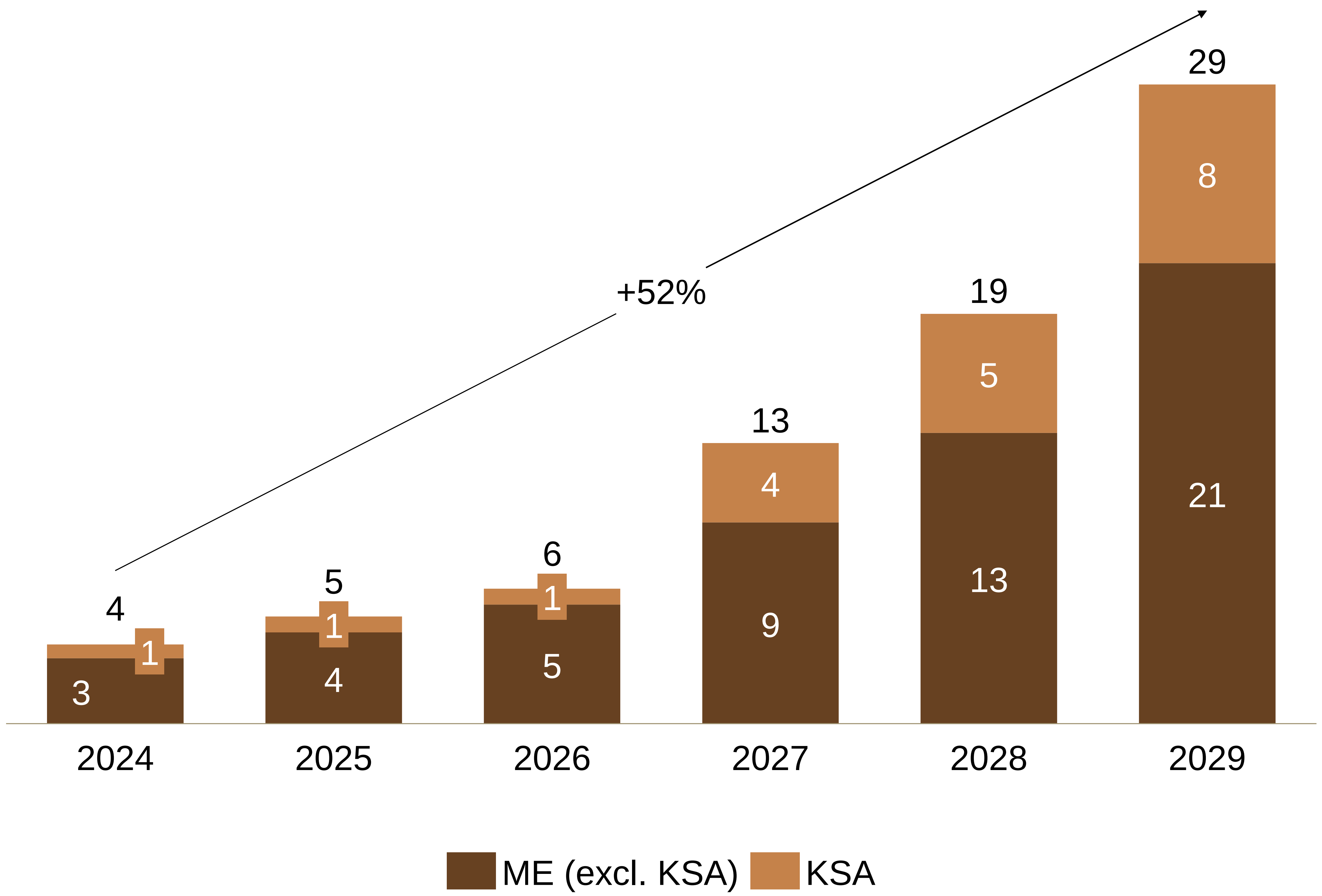
CCS additives demand, customers, and drivers

Forecasted GCC CCS market 2024-2029 ($MM)



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Catalyzing Supply Chains

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Value chain and key localization opportunities

	Raw materials	Intermediate process	Product formulation
Local saturation	Multiple players	Multiple player	Few players
Current value chain	• Raw material such as amines, phosphates available locally	• Availability of resources for the synthesis of ethanolamine and the production of biocides locally	• Opportunity to locally produce specialty corrosion inhibitors, biocide, and solvent stabilizers Opportunity

Success factors

	Raw materials	Intermediate process	Product formulation
Technology			• Advanced chemical formulation tools
Labor			• Chemical engineers with expertise in formulations

Process Chemicals workshop

Source: Expert interviews, team analysis

Please direct Business Opportunities inquiries below:

We invite you to engage with us and send us your Expression of Interest by scanning the QR code or visiting:

Website: https://iktva.sa/english/opportunities/opportunity-submission-form

Email: local-content@Aramco.com

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Thank You

Process Chemicals workshop

Catalyzing Supply Chains