



A collage of four images related to vinyl ester resin. Top left: A white cup containing a yellowish liquid with a wooden stirrer. Top right: A close-up of small, translucent, spherical resin particles. Bottom right: A clear glass jar filled with a yellowish liquid resin. The background features large blue and white geometric shapes.

GLOBAL VINYL ESTER RESIN MARKET

FORECAST & OPPORTUNITIES, 2030

PUBLISHED: September 2021

MARKET INTELLIGENCE. CONSULTING

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1. Executive Summary

Brief insight about the company and project:



Established - 1973

Turnover (Consolidated) - INR 5,39,238 Crore (FY Year 2020-21)

1.1. Overview of the Company:

- India based Reliance Industries Limited, one of the well-known MNCs which manufacture and sale diverse range of products including polymers, aromatics, elastomers etc. globally.
- The company caters customers and various industries viz., healthcare, automotive, packaging etc across over 70 countries worldwide.
- The company's total production capacity of PE, PP and PVC is 2.3, 2.9 and 0.7 million MT per annum, respectively as of 2019.
- The company exported 1.1 million MT of polymers globally in 2019.
- The company has 6 state-of-the-art manufacturing facilities to produce polymers.

1.2 Brief Profile of Board of Directors:

Mukesh Ambani: Mr. Mukesh D. Ambani (DIN 00001695) is a Chemical Engineer from the Institute of Chemical Technology, Mumbai (erstwhile the University Department of Chemical Technology, University of Mumbai). He pursued an MBA from Stanford University in the US. He has been on the Board of Reliance since 1977.

Nita M. Ambani: Mrs. Nita M. Ambani (DIN 03115198) is a Commerce Graduate from Mumbai University and a diploma holder in Early Childhood Education.

Hital R. Meswani: Mr. Hital R. Meswani (DIN 00001623) is a Management & Technology graduate from the University of Pennsylvania (UPenn) in the USA.

Nikhil R. Meswani: Nikhil Meswani is an Executive Director on the Board of Reliance. A chemical engineer from the University Institute of Chemical Technology (UICCT) Mumbai, he joined Reliance in 1986.

P.M.S. Prasad: PMS Prasad is an Executive Director at Reliance and one of the longest serving members on the Board and the company.

P.K. Kapil: PK Kapil is an Executive Director on the Board of Reliance. With experience spanning four decades, he is a driving force in the HSE, Technology, Reliability and Operations of all manufacturing sites.

R.A. Mashelkar: R.A. Mashelkar is an independent Director on the Board of Reliance. An eminent scientist and champion of the Innovation Movement in India, he is the Chairman of Reliance Innovation Council.

Adil Zainulbhai: Adil Zainulbhai is an independent Director on the Board of Reliance. One of the world's foremost consultants, he is a mechanical engineering graduate from IIT and holds an MBA from Harvard.

Mansingh L. Bhakta: Mansingh Bhakta is an independent Director on the Board of Reliance. An advocate par excellence, he has almost six decades of experience.

Dipak C. Jain: Dipak Jain is an independent Director on the Board of Reliance. One of the world's top educationalists, he is a former Dean of Kellogg School of Management and INSEAD.

Dharam Vir Kapur: Dharam Vir Kapur is an independent Director on the Board of Reliance. A technology, industrial development, and project implementation expert, he has a long and illustrious career in the Indian government.

Mahesh P. Modi: Mahesh Modi is an independent Director on the Board of Reliance. He has in-depth management experience in the petrochemical, telecommunications, energy, and insurance industries.

Yogendra P. Trivedi: Yogendra Trivedi is an independent Director on the Board of Reliance. He is an expert in the fields of economics, politics, education, sports, and social and professional services.

Ashok Misra: Ashok Misra is an independent Director on the Board of Reliance. An IIT Director from 2000-2008, Misra was the driving force behind its transformation into a leading research and development institute.

1.3 Brief Project Summary:

Vinyl ester resins (VERs) are high-performance unsaturated resins derived by the addition reaction of various epoxide resins with unsaturated carboxylic acids. These resins have been classified under unsaturated polyester resins & comes with different grades such as Bisphenol-A Epoxy Resin, Low styrene Monomer Bisphenol-A Resin, Novolac Based Epoxy Resin, Brominated Epoxy Resin, and multifunctional epoxy resins.

Vinyl ester resin are easy to manufacture as process is simple and all raw materials are available. Backward integration into raw materials such as Epoxy Resin, Styrene and Methacrylic Acid will allow consistent supply and competitive pricing of vinyl ester resin.

Key Highlights of the projects

Reliance Industries Limited (RIL) proposes to enter Vinyl Ester Resin business. With the increasing demand within India and across the globe, there is a great opportunity to enter in this manufacturing business. The company's total production capacity of PE, PP and PVC is 2.3, 2.9 and 0.7 million MT per annum, respectively as of 2019. Success for the greenfield project is mainly due to:

- Cost Competitiveness against all major companies operating in the market
- Early Adaptation of 5G Technology by telecom sector
- India being the Top 10 preference for FDI Inflows in the country.
- India being the 4th largest producer of Chemicals in Asia Pacific region.
- “AatmaNirbhar Bharat” and “Make in India” policies are further incentivizing domestic manufacturer to come up with green field capacity.

Demand for vinyl ester resin has been proposed to have double digit growth in India due to the robust growth in end user industries. India's Fiberglass Reinforced Plastics (FRP) coating and lining Industry has been witnessing high growth numbers due to increasing inclination towards corrosion resistant products and other technological advancements. Vinyl ester resin is also finding its wide applications majorly in materials for pipe linings, steel and concrete linings, secondary containment, and to fabricate FRP (Fiberglass Reinforced Plastics) storage tanks.

Vinyl ester resin prevents the hydrolysis induced osmotic blistering by the formation of skin between the gel coat and the glass/polyester laminate or over the gel coat. It can be used for the entire lamination of boats which provides greater flexibility and toughness than polyester.

Growth Drivers for India Vinyl Ester Market

Name of the Product	Domestic Demand Market	Export Potential	Import Substitution
FRP (Pipes and Tanks)	✓	✓	
Electronics and Telecommunication	✓	✓	✓
Marine Components	✓		
Renewable Energy (Wind)	✓	✓	
Aerospace and Defense	✓		✓
Chemicals	✓		✓

Product Profile

2.1. Product Overview (Introduction and Characteristics):

Vinyl Ester Resins are intermediate between polyester and epoxy resin specifically designed for greater resistance to vibrational loads. They are thermosetting group of resins derived from the reaction of epoxy resin and unsaturated carboxylic acid group such as methacrylic or acrylic acid.

Vinyl Ester Resin forms cross linking between epoxy backbone and functional side groups leaving fewer area to attach water molecule which means these resins are very resistant to water and other chemicals. As they are less susceptible to damage by hydrolysis, therefore find applications in pipes and chemical storage tanks, marine, recreation industries etc. This type of side group cross linking also provides vinyl ester resin with excellent thermal stability and are frequently found in applications such as semiconductor encapsulation, electronics, and communication, construction, and automobile industries.

Few globally used grades of vinyl ester resin are described below

S. No	Grade	Application
1	Bisphenol-A Epoxy Resin	Provide Resistance to acid, alkalis, solvents, excellent toughness, and fatigue resistance
2	Low styrene Monomer Bisphenol-A Resin	Chemical reaction vessels
3	Novolac Based Epoxy Resin	Excellent, thermal, and chemical resistance, resistance to solvents, acids
4	Brominated Epoxy Resin	High degree of fire retardance, resistance to chemical, tougher and fatigue resistant
5	Brominated Novolac Epoxy Vinyl Resin	Moderate degree of retardance, application in hot, wet flue gas environment
6	Elastomer-modified Bisphenol-A Epoxy Vinyl Resin	High impact and fatigue resistance, chemically resistant FRP linings
7	Urethane Modified Vinyl Ester Resin	Heat, Corrosion and Chemical resistant, application in marine, pultrusion, carbon fibre

With the growing fibre reinforced composites market in the Asia Pacific, the demand is high for predictable and cohesive vinyl ester resin and polyester resin systems. The experience of composites in quality infrastructure over the last 30 years has provided the boulders for new corrosion infrastructure applications that shall apply to Asian as well as global markets.

The usage of fiberglass reinforced underground gasoline storage tanks has been successful in the last quarter century. Power station pipes, some as large as 4.9 meters in diameter, have been performing well without any problem. The recently developed composite products include sewer liners, short span bridges for handling pedestrian bridges, regular road traffic, water covers for water treatment plants.

Vinyl ester resin composites have achieved a remarkable degree of commercial acceptance in a variety of applications like infrastructure, chemical and marine industry.

Polyester and Vinyl Ester Resins are among the most used matrix resins to create polymer composites. The formulations of Vinyl ester have been providing increased corrosion resistance and have a broad range of heat distortion, available strength, and shrinkage characteristics. The automotive and transportation industry is expected to drive the demand for composite materials. As the strength-to-weight ratio of most composites is higher than that of steel and aluminium. Vinyl ester resin stands serve as the intermediate chemical of epoxy and polyester in terms of mechanical properties and price.

2.2 Production routes & related details

Vinyl ester resin Technology is typically developed in-house with the critical equipment being outsourced. It requires in-house independent R & D, equipped with latest state of art technologies and facilities. Vinyl Ester Resin is mainly of three types, namely Bisphenol A, F, S Vinyl Ester Resin, Novolac Vinyl Ester Resin, and Brominated Vinyl Ester Resin.

Some applications of Novolac vinyl ester resin includes heat shields, resistance coatings, parts for flue gas desulfurization, chimney liners, and other structural composite components where high heat resistance is required. The Brominated vinyl ester resins are flame retardant and provide corrosion resistance from a wide variety of acidic and alkaline environments.

Novolac based vinyl ester resin, despite possessing better properties than Bisphenol A vinyl ester resin, holds less share than Bisphenol A as the technology to manufacture is quite complex, expensive, requires infrastructure, raw materials, & above all expertise. Others include urethane and elastomer modified vinyl ester resins which are modified with many unique features, providing exceptional characteristics. The elastomer modified may also be used as a primer on carbon steel, high density PVC foam and other dissimilar substrates.

Production Route for producing Bisphenol A Based Vinyl Ester Resin:

Firstly, Epoxy resin and Bisphenol are added to the reactor and heated to the temperature of 170 C and that temperature should be maintained for a period of 2-4 hours. Secondly, Epoxy equivalent weight is measured and after an optimum value has been achieved then it is allowed to cool down to 100 C and then finally to 80 C. Solid resins from the reactor is then discharged into styrene monomer containing blender and the temperature of the discharge resin should not rise above 70 C. To limit the temperature to the required limit water needs to be circulated around the blender. Finally, viscosity, gel time etc testing are to be done and should be adjusted accordingly.

Mass Balance:

INPUT	QUANTITY (MT/MT)	OUTPUT	QUANTITY (MT/MT)
Epoxy Resin	0.30	Vinyl Ester Resin	1.0
Bisphenol-A	0.14	By Product	Nil
Methacrylic Acid	0.11	Yield Loss	0.00
Styrene Monomer	0.45	Gaseous	-
Total	1.00	Total	1.00

Production Route For Novolac Based Vinyl Ester Resin: Initially, reactor should be charged with required quantity of solid Novolac epoxy resin and should be heated to 100 C. After that, Methacrylic Acid and Maleic Anhydride are added to the reactor, while adding, temperature of the reactor should be maintained between 90 C to 100 C. Finally, Solid Novolac resin from the reactor needs to be discharged into a styrene monomer containing blender.

Mass Balance:

INPUT	QUANTITY (MT/MT)	OUTPUT	QUANTITY (MT/MT)
Epoxy Resin	0.40	Vinyl Ester Resin	1.0
Methacrylic Acid	0.12	By Product	Nil
Tri Ethyl amine	0.01	Yield Loss	-
Maleic Anhydride	0.03	Gaseous	-
Styrene Monomer	0.45	Solid waste	-
Total	1.00	Total	1.00

2.3 Properties and Applications

Property	Bisphenol-A	Bisphenol-A	Novolac
Viscosity, cP, 25°C	200~700	2000~3000	300~500
Specific Gravity, 25°C	1.04~1.06	1.06~1.08	1.07~1.09
Gel Time *a, minutes, 25°C	20~30	20~30	15~25
	Co(6%)=0.4%	Co(6%)=0.4%	Co(6%)=0.4%
	MEKPO=1.6%	MEKPO=1.6%	MEKPO=1.2%
Styrene Content, %	43~47	33~37	31~35
Stability, Dark at 25°C(month)	6	6	3

Product Name	Features	Applications
Bisphenol-A	■ Low viscosity.	■ Raw material tanks, pipe and process equipment.
	■ Excellent mechanical properties and easy processing.	■ Most commercial FRP fabrication processes.
	■ Excellent corrosion resistance to a wide range of acids, alkalis and salt solutions.	■ Anti-corrosion tank linings and coatings.
	■ Comply with FDA regulation 21 CFR 177.2420 when treated well.	■ Yacht, Wind turbine blade.
	■ Obtained the DNV Type Approval Certificate.	
Bisphenol-A	■ High viscosity (SM=35%).	■ Fabricating tanks, pipe and process equipment.
	■ Excellent mechanical properties and corrosion resistance.	
Novolac	■ Excellent mechanical properties, good retention of strength and toughness at high temperatures.	■ High temperature chlorination or caustic scrubbing tower and storage tank.
	■ High resistance to solvents and chemicals.	■ Industrial waste treatment facilities.
	■ Excellent resistance to acidic oxidizing environments.	■ Flue gas desulfurization (FGD) system.
		■ Hydrochloric acid tank truck, organic solvent storage tank and most commercial FRP fabrication processes.

2.4 End of Life and Sustainability

Health, Safety & Environment (HSE) :

Vinyl Ester Resin grades are classified under category 3 of flammable liquids, further these Resins are classified under health hazards in different categories mention below.

Health Hazards	Category
Acute toxicity (inhalation: vapour)	Category 4
Skin corrosion/irritation	Category 2
Serious eye damage/eye irritation	Category 2
Germ cell mutagenicity	Category 2
Specific target organ toxicity — single exposure (central nervous system)	Category 1
Specific target organ toxicity — Single exposure	Category 3, (Respiratory tract irritation)
Specific target organ toxicity — Repeated exposure	Category 1 (respiratory system, liver, nervous system, blood)

Source: - SHOWA DENKO K.K

Under Environmental hazards, Vinyl ester resins are classified under category 2 for aquatic environment.

End of the life

Vinyl Ester Resin have maximum shelf life of around 18 months when stored in a controlled environment as per guidelines issued by manufacturer. The Shelf life of the product depends on grade and company to company. For Instance, Derakane™ Signia™ produce by IENOS claim to have a shelf life of 18 months.

3. Market Outlook and Relevance of the Project

3.1. Demand Supply Outlook – Global Vinyl Ester Resin Market

Global Vinyl Ester Resin Demand-Supply Scenario, 2015-2030F (000' Tonnes)

Parameters	2015	2020	2021E	2025F	2030F
Global Vinyl Ester Resin Capacity	938	985	1020	1025	1030
Global Vinyl Ester Resin Production	733	759	808	866	929
Global Vinyl Ester Resin Demand	677	739	789	1026	1367
Global Vinyl Ester Resin Demand (Y-O-Y Growth Rate, %)	3.87%	-7.14%	6.71%	6.42%	5.58%

Source: TechSci Research

- Demand has increased after the slump of 2020, where downstream sectors have increased consumption in the wake of economic recovery. A trend has been witnessed where the companies having captive market have gained improved margins while others have witnessed a cutback in margins due to uneven price assessments of raw materials. Demand from the marine and renewables sector has shown an upward trend contributing to the increase in demand in 2021.
- Owing to its high viscosity index, crack resistance, resistance to high temperature and others, the total demand of vinyl ester is anticipated to reach 1.37million tonnes.
- APAC and North America region accounted for the largest share in the global vinyl ester resin based FRP composites market in 2020 and 1st half of 2021 and trend is expected to remain same during forecast period as well, owing to growing demand across various end use industries. The aerospace industries in the USA and Mobile Manufacturing units in North-East Asia are the largest in the world and is emanating high demand for composites for manufacturing fighter aircraft, airplanes, LCD panels and their components.

Global Vinyl Ester Resin Demand, By Volume (000' Tonnes), 2015–2030F



- The betterment of supply chain management and rising demand from various end user industries contributed to the increasing market for vinyl ester resin.
- Companies have been noticing the rise in their revenue quarterly, especially through vinyl ester resin. INEOS Group and Hexion Inc. both witnessed the increase in revenues by 26% and 13%, respectively from Q1 2021 to Q2 2021.
- The Increase in demand is led by strong demand for excellent chemical and thermal resistant material in downstream applications such as semiconductor encapsulation, electronics and communication, construction, and automobile industries.

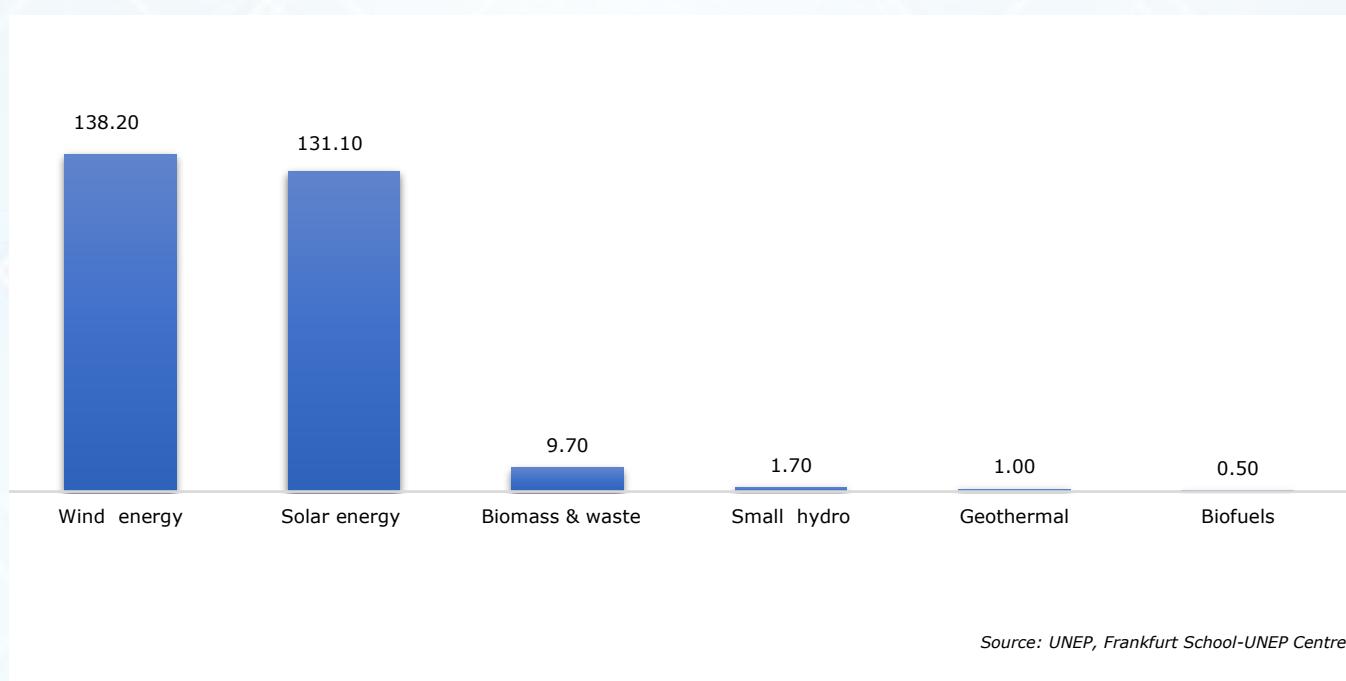
3.1.1. Capacity By Company

Global Vinyl Ester Resin Capacity, By Company (000' Tonnes), 2015-2030F

Company	Capacity					
	Location	2015	2020	2021E	2025F	2030F
AOC Resins	China	70.0	70.0	70.0	70.0	70.0
	Switzerland	5.0	5.0	5.0	5.0	5.0
	USA	60.0	70.0	70.0	70.0	70.0
INEOS Composites	China	50.0	50.0	50.0	50.0	50.0
	Germany	0.0	30.0	30.0	30.0	30.0
	USA	50.0	85.0	85.0	85.0	85.0
Swancor Holding Co., LTD.	Taiwan	60.0	70.0	70.0	70.0	70.0
Showa Denko K.K.	China	20.0	20.0	50.0	50.0	50.0
	Japan	20.0	20.0	20.0	20.0	20.0
	Singapore	15.0	15.0	15.0	15.0	15.0
Scott Bader Company Ltd.	France	15.0	15.0	15.0	15.0	15.0
	United Kingdom	20.0	20.0	20.0	20.0	20.0
	United Arab Emirates	20.0	20.0	20.0	20.0	20.0
Polynt-Reichhold	India	0.4	0.4	0.4	0.4	0.4
	Italy	5.0	5.0	5.0	5.0	5.0
	USA	35.0	35.0	35.0	35.0	35.0
Eternal Materials Co.,Ltd.	China	10.0	10.0	10.0	10.0	10.0
	Taiwan	20.0	20.0	20.0	20.0	20.0
	Malaysia	10.0	15.0	15.0	15.0	15.0
Sino Polymer	China	20.0	20.0	20.0	20.0	20.0
	Italy	18.0	18.0	18.0	18.0	18.0
Hexion Inc.	Netherlands	30.0	30.0	30.0	30.0	30.0
DIC Corporation	Japan	30.0	30.0	30.0	30.0	30.0
Poliya	Russia	15.0	15.0	15.0	15.0	15.0
	Turkey	15.0	15.0	15.0	15.0	15.0
Saudi Arabia Industrial Resins Ltd.	Saudi Arabia	20.0	20.0	20.0	20.0	20.0
Reinhold GmbH	Germany	20.0	20.0	20.0	20.0	20.0
Interplastic Corporation	USA	20.0	20.0	20.0	20.0	20.0
Allnex group	Germany	20.0	20.0	20.0	20.0	20.0
En Chuan Chemical Industries Co., Ltd.	Taiwan	10.0	10.0	10.0	10.0	10.0
SEWON CHEMICAL	South Korea	3.0	3.0	3.0	3.0	3.0
Innovative Resins Pvt. Ltd.	India	1.8	1.8	1.8	1.8	1.8
Orson Chemicals	India	0.7	0.7	0.7	0.7	0.7
Satyen Polymers Pvt. Ltd.	India	0.6	0.6	0.6	0.6	0.6
Crystic Resins India Private Limited	India	0.6	0.6	0.6	0.6	0.6
Mechemco resins pvt ltd	India	0.4	0.4	0.4	0.4	0.4
Moras Chemicals India Pvt. Ltd.	India	0.4	0.4	0.4	0.4	0.4
Ashland Global Holdings Inc.	Germany	25.0	0.0	0.0	0.0	0.0
	USA	30.0	0.0	0.0	0.0	0.0
Others		172.3	184.3	189.3	194.3	199.3
Total		938.1	985.1	1020.1	1025.1	1030.1

- Major manufacturing company like INEOS Composites had acquired the Ashland's composite business in 2019.
- In 2020, Showa Denko K.K, a Japanese Vinyl Ester Resin producer expanded its VER production line to almost double of its existing capacity through its Chinese subsidiary Shanghai Showa Highpolymer Co., Ltd. (SSH).
- Also, in 2014 Chinese Vinyl Ester resin market leader Sino Polymer Co. Ltd announced strategic cooperation with Europe's Nord Composites under which Nord Composites would produce Sino Polymer's MFE brand of VER in its plant located in Italy.

Global Investment in Renewable Energy Capacity by Sector in 2019 (USD Billion)



3.1.2. Production By Company

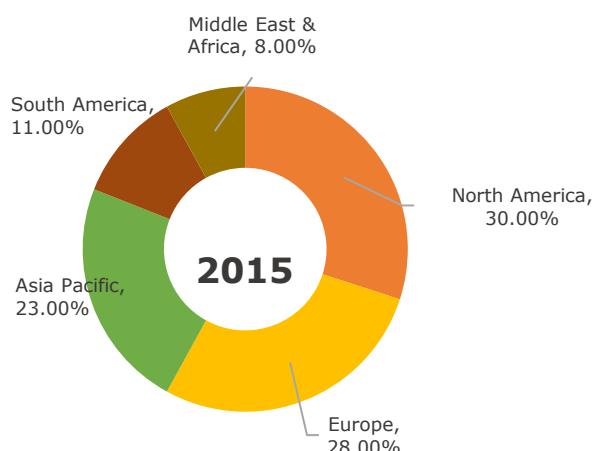
Global Vinyl Ester Resin Production, By Company (000' Tonnes), 2015-2030

Company	Production				
	2015	2020	2021E	2025F	2030F
AOC Resins	117	117	116	132	140
INEOS Composites	29	81	81	89	98
Swancor Holding Co., LTD.	44	56	59	63	67
Showa Denko K.K.	44	45	71	75	81
Scott Bader Company Ltd.	45	45	46	47	50
Polynt-Reichhold	33	40	40	42	43
Eternal Materials Co.,Ltd.	31	34	35	43	46
Sino Polymer	30	29	31	32	33
Poliya	26	25	26	27	28
Hexion Inc.	24	24	25	25	25
DIC Corporation	22	24	25	26	27
Saudi Arabia Industrial Resins Ltd.	15	16	17	18	19
Reinhold GmbH	15	15	16	16	18
Interplastic Corporation	15	14	14	15	16
Allnex group	15	14	15	16	18
En Chuan Chemical Industries Co., Ltd.	7	7	8	9	9
Sewon Chemical	2	3	3	3	3
Innovative Resins Pvt. Ltd.	1	1	1	2	2
Orson Chemicals	1	1	1	1	1
Satyen Polymers Pvt. Ltd.	0.5	0.5	0.4	0.5	0.6
Crystic Resins India Private Limited	0.4	0.5	0.4	0.5	0.5
Mechemco Resins pvt Ltd	0.3	0.3	0.3	0.4	0.4
Moras Chemicals India Pvt. Ltd.	0.3	0.3	0.3	0.3	0.3
Ashland Global Holdings Inc.	45	0	0	0	0
Others	171	166	179	185	203
Total	733	759	808	866	929

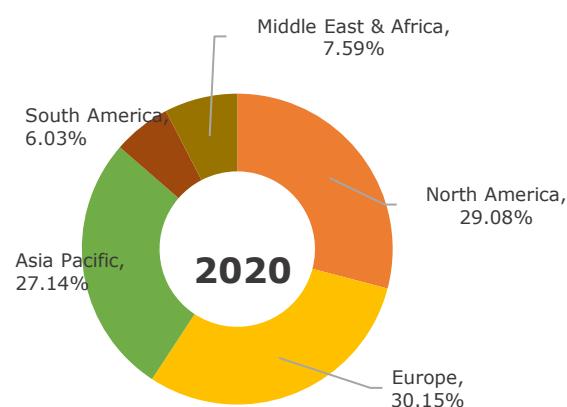
Source: TechSci Research

- The increase in production is mainly led by solid demand for vinyl ester resin in downstream fiber reinforced plastic (FRP) applications.
- Asia Pacific region holds approximately 44% of the total production capacity, which can be attributed to the presence of major players like Jinling AOC Resins Co., Ltd., Showa Denko K.K., Sino Polymer, INEOS Composites, among others.
- The total production value in 2020 saw a decline of approximately 8% as compared to the 2019 production level. However, approximately 7% growth in production is expected in 2021 due to increasing demand of vinyl ester resin globally.

Global Advanced Composites Market Share, By Region, By Value, 2015 & 2020



Source: TechSci Research



Source: TechSci Research

3.1. 4. Operating Efficiency By Company

Global Vinyl Ester Resin Operating Efficiency, By Company, 2015-2030F

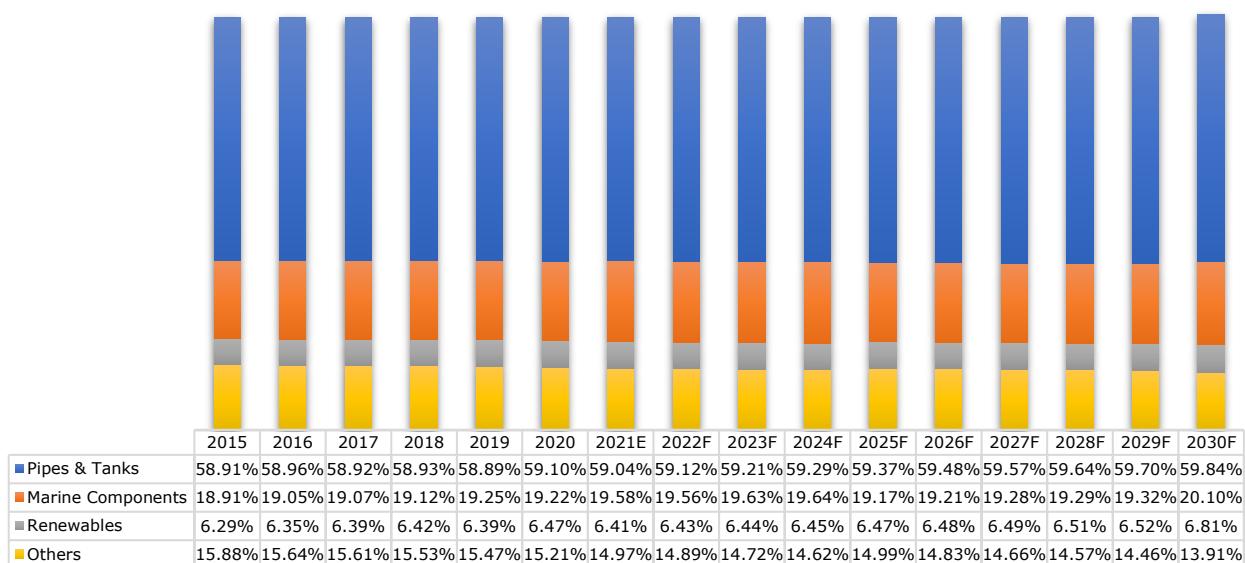
Company	Operating Efficiency (%)				
	2015	2020	2021E	2025F	2030F
AOC Resins	87	81	80	91	96
INEOS Composites	29	49	49	54	59
Swancor Holding Co., LTD.	73	80	84	90	96
Showa Denko K.K.	79	82	84	88	95
Scott Bader Company Ltd.	82	82	84	86	91
Polynt-Reichhold	81	80	80	85	86
Eternal Materials Co.,Ltd.	77	76	79	86	93
Sino Polymer	80	77	81	84	88
Poliya	85	85	86	89	93
Hexion Inc.	79	80	83	84	85
DIC Corporation	75	79	82	86	91
Saudi Arabia Industrial Resins Ltd.	76	78	86	89	97
Reinhold GmbH	77	74	78	82	90
Interplastic Corporation	75	72	71	77	78
Allnex group	75	72	73	80	90
En Chuan Chemical Industries Co., Ltd.	72	73	77	87	93
SEWON CHEMICAL	81	84	87	92	96
Innovative Resins Pvt. Ltd.	76	80	74	84	91
Orson Chemicals	78	82	76	86	93
Satyen Polymers Pvt. Ltd.	77	81	71	79	92
Crystic Resins India Private Limited	74	79	68	77	90
Mechemco resins pvt ltd	73	76	80	90	95
Moras Chemicals India Pvt. Ltd.	88	79	83	86	93
Ashland Global Holdings Inc.	81	0	0	0	0

Source: TechSci Research

- Globally, companies are producing at high operating rates in 2021 than last year due to increasing demand of FRP coating and lining from the pipes & tanks industry, construction sector and marine industry.
- Moreover, rising investment in the defense sector by major economies drove the companies to operate at higher efficiency.
- Other factors supporting operating rates are increasing investment in renewable energy sources like wind and solar energy in emerging economies in the Asia Pacific.

3.1.5. Demand By Application

Global Vinyl Ester Resin Demand, By Application, By Volume (000' Tonnes), 2015–2030F



Others include Defense, Aerospace, Electrical and electronics etc.

Source: TechSci Research

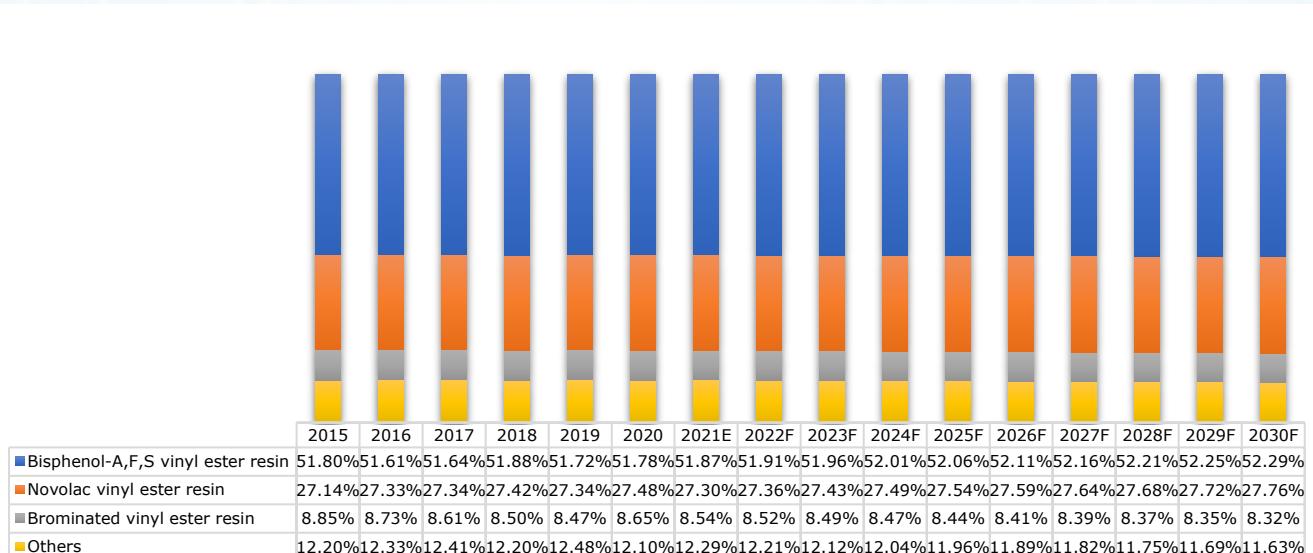
Demand by Application (000' Tonnes)	2015	2016	2017	2018	2019	2020	2021E	2025F	2030F
Pipes & Tanks	399	417	433	452	469	437	466	609	818
Marine Components	128	135	140	147	153	142	155	197	270
Renewables	43	45	47	49	51	48	51	66	89
Others	108	111	115	119	123	112	118	154	190
Total	677	708	735	767	796	739	789	1026	1367

Others include Défense, Aerospace, Electrical and electronics etc.

Source: TechSci Research

3.1.6. Demand By Type

Global Vinyl Ester Resin Demand, By Type, By Volume (000' Tonnes), 2015–2030F



Others include Urethane Modified vinyl ester resin, Elastomer Modified vinyl ester resin etc.

Source: TechSci Research

Demand by Type (000' Tonnes)	2015	2016	2017	2018	2019	2020	2021E	2025F	2030F
Bisphenol-A,F,S vinyl ester resin	351	365	379	398	412	383	409	534	715
Novolac vinyl ester resin	184	193	201	210	218	203	215	283	380
Brominated vinyl ester resin	60	62	63	65	67	64	67	87	114
Other chemistry	83	87	91	94	99	89	97	123	159
Total	677	708	735	767	796	739	789	1026	1367

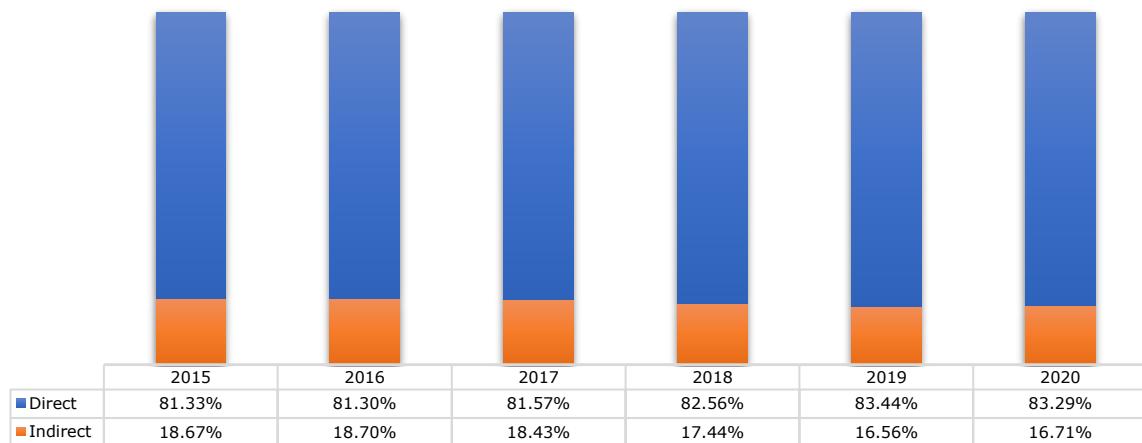
Others include Urethane Modified vinyl ester resin, Elastomer Modified vinyl ester resin etc.

Source: TechSci Research

- The Bisphenol- A type vinyl ester resin contributes to around 50% of the global vinyl ester resin types due to its excellent properties of corrosion resistance to a variety of alkalis, organic and inorganic salts, salt solutions and oxidizing chemicals, etc
- As Bisphenol A has been banned in Europe, the demand for Bisphenol A Vinyl Ester Resin is expected to gradually decrease as Bisphenol A will be replaced by Bisphenol F and S.
- Novolac vinyl ester resin contributes to around 27% which has been specially modified for improved fabrication properties. It provides improved product quality and fabrication efficiency to ens users, which offers extended shelf life and adds improved flexibilty to fabricators.

3.1.7. Demand By Sales Channel

Global Vinyl Ester Resin Demand, By Sales Channel, By Volume (000' Tonnes), 2015–2030F



Source: TechSci Research

Demand by Sales Channel (000' Tonnes)	2015	2016	2017	2018	2019	2020	2021E
Direct	551	575	599	634	664	616	551
Indirect	126	132	135	134	132	124	126
Total	677	708	735	767	796	739	677

Source: TechSci Research

3.1.8. Demand By Region

Global Vinyl Ester Resin Demand, By Region, By Volume (000' Tonnes), 2021E & 2030F

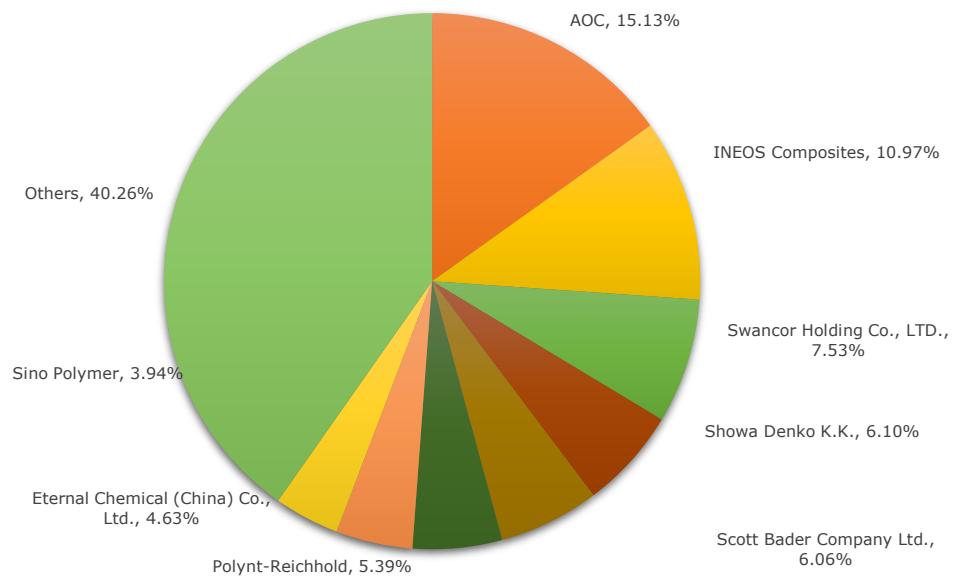
Region/Country	2015	2020	2021E	2025F	2030F	CAGR (2015-2020)	CAGR (2021E-2030F)
Asia Pacific	283.31	322.29	349.49	484.81	688.20	2.61%	14.51%
India	8.68	10.11	11.08	16.81	30.00	3.10%	11.70%
China	131.22	145.16	158.00	224.03	330.68	2.04%	8.55%
Japan	45.66	47.05	54.59	78.69	123.33	0.60%	9.48%
South Korea	35.24	40.77	45.57	67.00	97.79	2.96%	8.85%
Others	62.50	79.19	80.24	98.28	106.41	4.85%	3.19%
Global APAC (Percentage Share)	41.82%	43.58%	44.29%	47.24%	50.33%		
Europe	171.09	177.60	187.10	228.54	281.95	0.75%	8.55%
Germany	32.918	34.667	37.015	46.458	58.465	1.04%	5.21%
France	16.087	15.930	16.136	18.444	23.385	0.44%	4.84%
United Kingdom	18.097	17.369	17.576	20.013	25.254	-0.89%	3.76%
Others	103.988	109.630	116.370	143.627	174.845	2.17%	5.02%
Global Europe (Percentage Share)	25.25%	24.02%	23.71%	22.27%	20.62%		
North America	152.59	163.53	172.74	214.79	274.88	1.40%	9.74%
USA	139.69	148.44	157.45	198.30	256.65	1.22%	5.58%
Canada	6.10	6.59	7.01	9.25	12.34	1.55%	6.48%
Mexico	6.79	8.50	8.27	7.24	5.89	4.59%	-3.70%
Global North America (Percentage Share)	22.52%	22.11%	21.89%	20.93%	20.10%		
South America	19.61	20.28	20.94	24.97	30.62	0.67%	7.90%
Brazil	11.97	12.49	12.94	15.66	19.61	0.84%	4.72%
Argentina	0.79	1.02	1.01	1.10	1.28	5.21%	2.65%
Others	6.85	6.77	6.98	8.21	9.73	-0.22%	3.75%
Global South America (Percentage Share)	2.90%	2.74%	2.65%	2.43%	2.24%		
Middle East and Africa	50.89	55.79	58.83	73.14	91.68	1.86%	9.28%
Saudi Arabia	17.32	19.64	21.06	23.48	28.96	2.55%	3.60%
Others	33.57	36.15	37.78	49.66	62.72	1.49%	5.80%
Global MEA (Percentage Share)	7.51%	7.54%	7.46%	7.13%	6.71%		

Source: TechSci Research

- With the countries moving towards more and more sustainable energy solutions, the demand for wind energy is expected to grow exponentially in the Asia Pacific during the forecast period, hence the region will keep the lion's share of global market for Vinyl Ester Resin.

3.1.9. Sales By Company

Global Vinyl Ester Resin Sales, By Company, By Volume (000' Tonnes), 2020



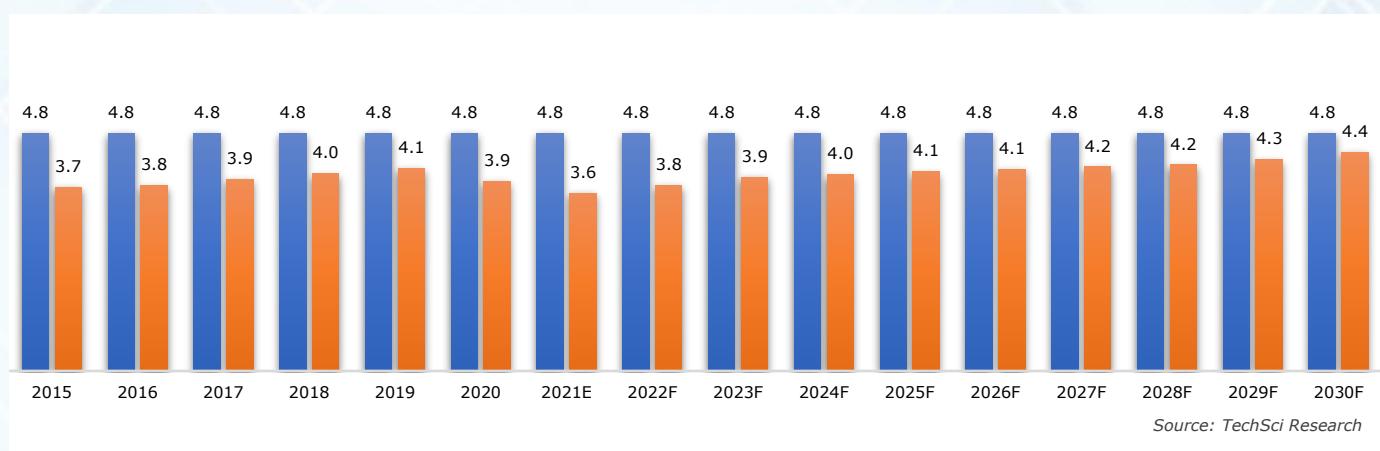
Others include Poliya, Hexion Inc., DIC Corporation, Saudi Arabia Industrial Resins Ltd., Reinhold GmbH, Interplastic Corporatio, Allnex Group, Sewon Chemical, Innovative Resins Pvt. Ltd., Orson Chemicals etc.

Source: TechSci Research

- AOC is leading the market, followed by INEOS Composites and Swancor Holding Co., Ltd.
- AOC, the leader in composites market, has been able to bring novel styrene free resins to commercial sales in the last twenty years and has also partnered with various companies to develop out of the box solutions which may bring both sustainability and performance.
- INEOS Composites provides high quality vinyl ester products such as AME™, Arotran™, Derakane™, Derakane™ Signia™, Hetron™.
- Most of the Indian companies such as Mechemco resins Pvt Ltd., Innovative Resins Pvt. Ltd. etc. manufacture vinyl ester of INEOS's vinyl ester quality. The major drivers identified for their growth are robust supply chain management clubbed with proposed expansion plans for upcoming Vinyl Ester Resin manufacturing facilities.

India Demand Supply Scenario 2015 – 2030F

India Vinyl Ester Resin Capacity, Production and Demand, By Volume (000' Tonnes), 2015 - 2030F

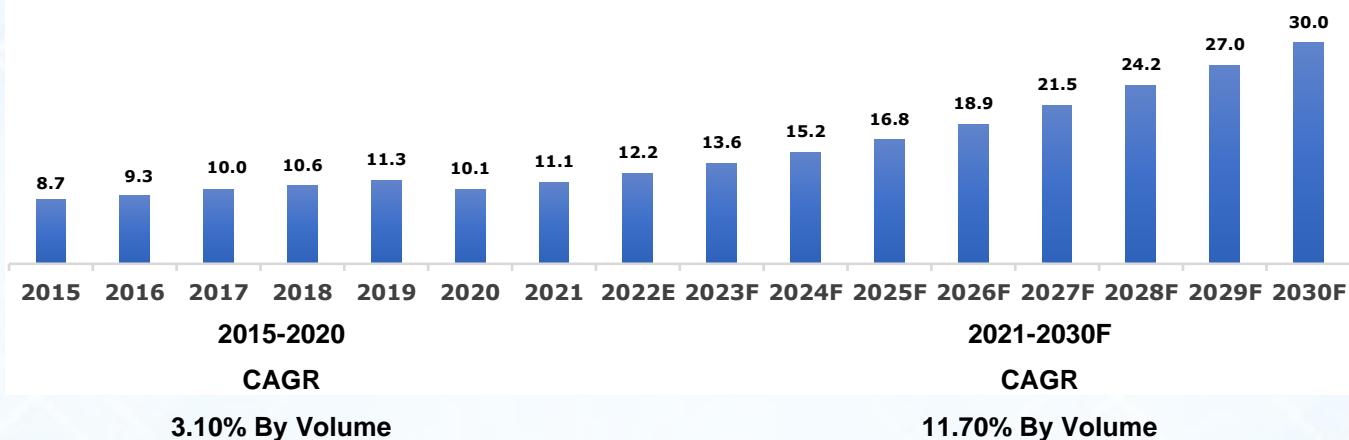


Company (000' Tonnes)	Location	2015	2020	2030F
Orson Chemicals	Silvassa	0.72	0.72	0.72
Reichhold India Pvt. Ltd.	Maharashtra	0.36	0.36	0.36
Moras Chemicals India Pvt. Ltd.	Gujarat	0.36	0.36	0.36
Innovative Resins Pvt. Ltd.	Rajasthan	1.8	1.8	1.8
Mechemco resins pvt ltd	Maharashtra	0.4	0.4	0.4
Satyen Polymers Pvt. Ltd.	Maharashtra	0.6	0.6	0.6
Crystic Resins India Private Limited	Haryana	0.6	0.6	0.6
Total		4.84	4.84	4.84

- The Indian market for Epoxy Resins is quite fragmented and none of the manufacturers have capacity more than 100 tonnes per month.
- The Indian total capacity stands at 4.84 thousand Tonnes. Most of the manufacturing plants are in Western and Northern region of India like Maharashtra, Gujarat, Haryana and Rajasthan.

- The market share of Innovative Resins Pvt Ltd. is approximately 35% in the domestic market followed by Orson Chemicals, Satyen Polymers Pvt Ltd, ad Crystic Resins India Private Limited with market share of approximately 14%, 12% and 11%.

India Vinyl Ester Resin Demand, By Volume (000' Tonnes), 2015-2030F



Source: TechSci Research

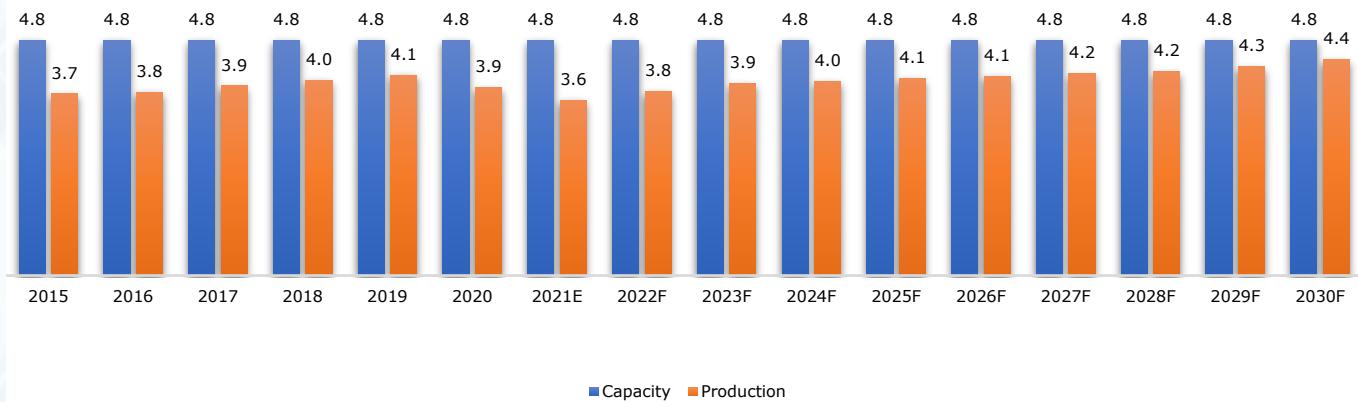
Development of 5G technology in India will increase the demand of VER

- 5G is a fifth-generation cellular network technology which tends to increase the internet speed up to 100 gigabits per second and is expected to be 100 times faster than fourth generation technology (4G) and provides lower latency.
- 5G will be able to support huge number of connected devices without lags and can provide longer battery life which is expected to propel the market of IoT across various manufacturing units. 5G is the foundation for realizing the full potential of IoT.
- For instance, in 2020, Bharti Airtel Ltd launched its internet of things (IoT) platform for enterprises to connect and manage billions of devices and applications. Largest Telecom Player in terms of market share, Reliance Jio announced launch of Jio Phone Next with collaboration of Google.

India Vinyl Ester Resin Trade Dynamics, By Value (USD million) By Volume- (000' tonnes)

Imported Country	2019		2020		2021	
	Value	Volume	Value	Volume	Value	Volume
Spain	6.36	2.44	5.34	2.09	3.57	1.27
United Kingdom	0.80	0.02	1.74	0.59	0.13	0.05
China	0.94	0.27	1.70	0.53	0.86	0.28
Taiwan	1.42	0.63	0.99	0.49	0.21	0.08
Japan	0.00	0.00	0.76	0.29	0.37	0.14
Others	3.93	4.54	2.60	2.71	7.59	5.48
Total	13.45	7.9	13.12	6.7	12.74	7.3
Exported Country	2019		2020		2021	
	Value	Volume	Value	Volume	Value	Volume
Saudi Arabia	0	0.02	0	0.01	0.02	0.15
Qatar	0.06	0.16	0.03	0.08	0.02	0.06
Bangladesh	0	0.32	0	0	0	0.01
United Arab Emirates	0	0.01	0.01	0.03	0	0
Bahrain	0	0	0	0	0	0.01
Others	0.04	0.09	0.03	0.28	0.01	0.03
Total	0.1	0.6	0.07	0.4	0.05	0.26

Source: DGFT

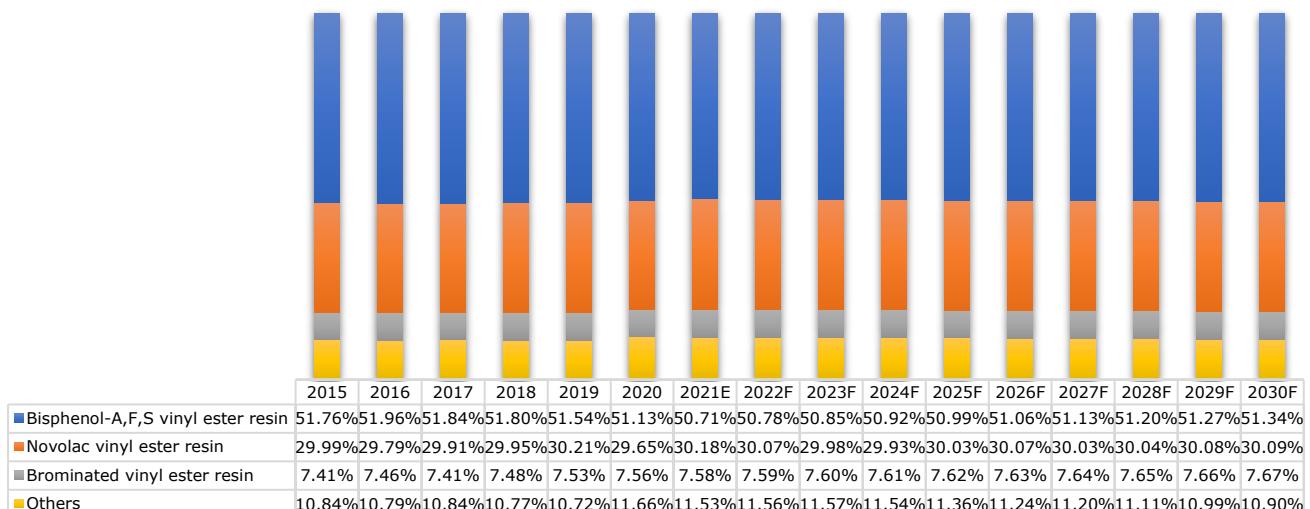


■ Capacity ■ Production

Source: TechSci Research

Demand By Type

India Vinyl Ester Resin Demand, By Type, By Volume (000' Tonnes), 2015–2030F



Others include Urethane Modified vinyl ester resin, Elastomer Modified vinyl ester resin etc.

Source: TechSci Research

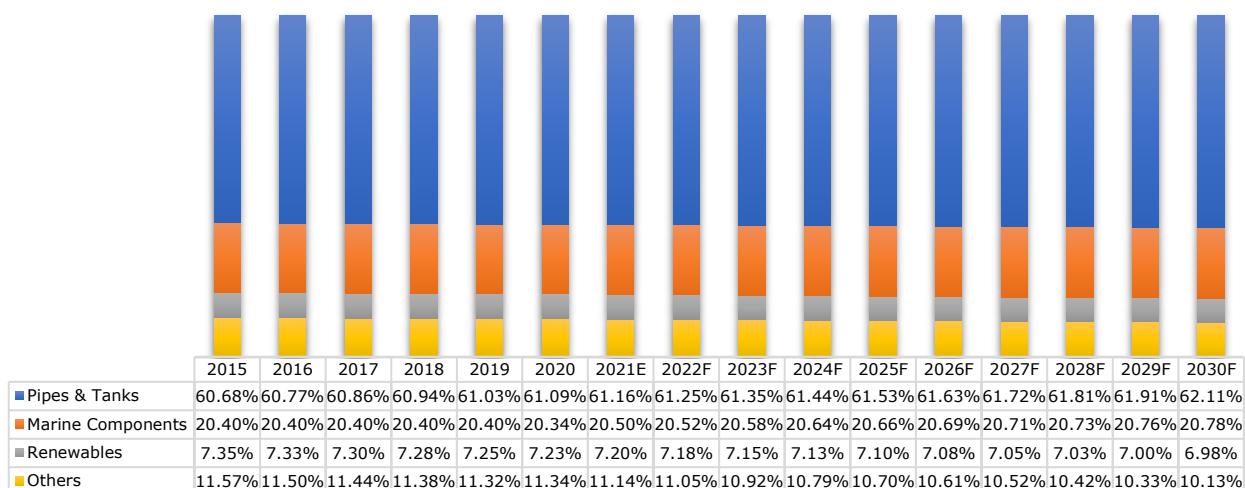
Demand by Type (000' Tonnes)	2015	2016	2017	2018	2019	2020	2021E	2025F	2030F
Bisphenol-A,F,S vinyl ester resin	4.5	4.8	5.2	5.5	5.8	5.2	5.6	8.6	15.4
Novolac vinyl ester resin	2.6	2.8	3.0	3.2	3.4	3.0	3.3	5.1	9.0
Brominated vinyl ester resin	0.6	0.7	0.7	0.8	0.9	0.8	0.8	1.3	2.3
Other chemistry	0.9	1.0	1.1	1.1	1.2	1.2	1.3	1.9	3.3
Total	8.7	9.3	10.0	10.6	11.3	10.1	11.1	16.8	30.0

Others include Urethane Modified vinyl ester resin, Elastomer Modified vinyl ester resin etc.

Source: TechSci Research

Demand By Application

India Vinyl Ester Resin Demand, By Application, By Volume (000' Tonnes), 2015–2030F



Others include Défense, Aerospace, Electrical and electronics etc.

Source: TechSci Research

Demand by Application (000' Tonnes)	2015	2016	2017	2018	2019	2020	2021E	2025F	2030F
Pipes & Tanks	5.3	5.6	6.1	6.4	6.9	6.2	6.8	10.3	18.6
Marine Components	1.8	1.9	2.0	2.2	2.3	2.1	2.3	3.5	6.2
Renewables	0.6	0.7	0.7	0.8	0.8	0.7	0.8	1.2	2.1
Others	1.0	1.1	1.1	1.2	1.3	1.1	1.2	1.8	3.0
Total	8.7	9.3	10.0	10.6	11.3	10.1	11.1	16.8	30.0

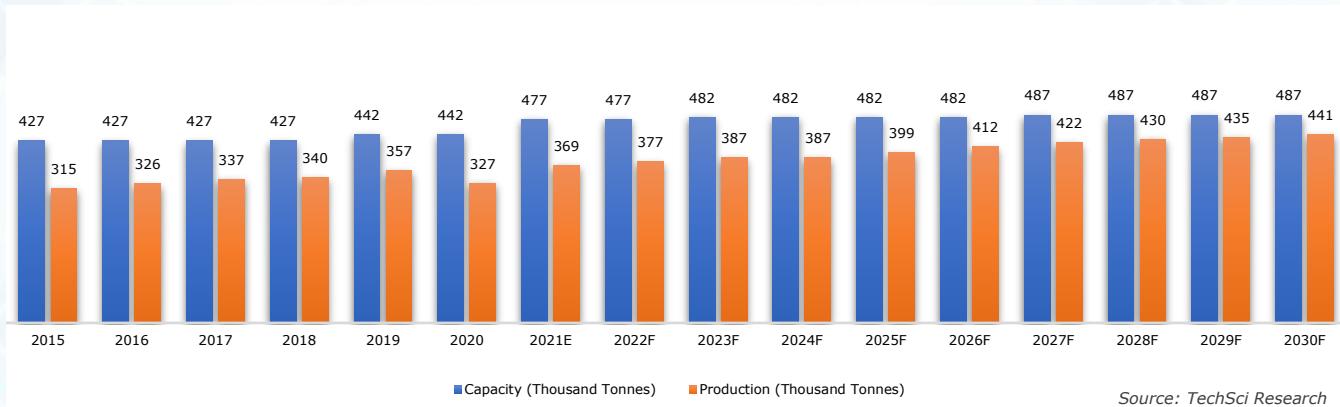
Others include Défense, Aerospace, Electrical and electronics etc.

Source: TechSci Research

ASIA PACIFIC VINYL ESTER RESIN DEMAND SUPPLY OUTLOOK



Asia Pacific Vinyl Ester Resin Capacity & Production (000' Tonnes), 2015-2030F



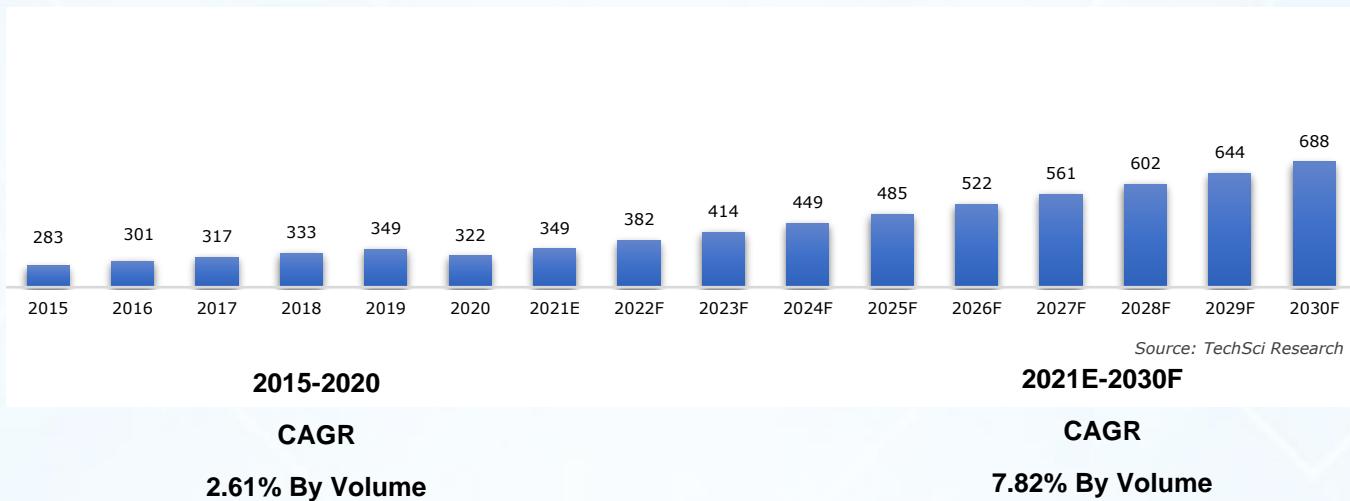
Source: TechSci Research

Company (000' Tonnes)	2015	2020	2030F
Jinling AOC Resins Co., Ltd.	70	70	70
Swancor Holding Co., LTD.	60	70	70
INEOS Composites	40	40	40
DIC Corporation	30	30	30
Sino Polymer	20	20	20
Others	314	324	334
Total	427	442	487

Source: TechSci Research

3.2.1. Asia Pacific Demand Supply Outlook

Asia Pacific Vinyl Ester Resin Demand, By Volume (000' Tonnes), 2015–2030F

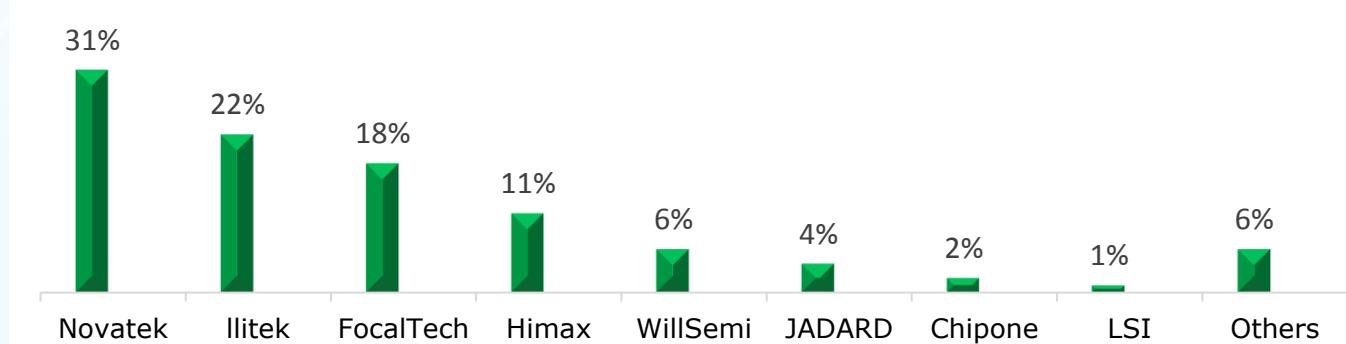


- Exports are higher than imports due to the presence of major vinyl ester resin producers in the region.
- Total export in 2020 stood at around 23 while imports stood at around 24 thousand tonnes. Increasing export is attributed to the increasing demand for vinyl ester resin from fibre reinforced plastic (FRP) application in the pipe and tank industry.
- Several manufacturers are investing heavily in capacity expansion to meet the growing demand for vinyl ester resin in the region.

Electronic, Telecommunication and Renewables sector have high latent demand in APAC region:

- Increasing market of electronic parts due to development in telecommunication technologies as well as 5G revolution in mobile application has led to increase in consumption of LCD and touch panels leading to increasing demand of Vinyl ester resin.
- Vinyl ester resin is used as inner lining material in electronic items due to its excellent corrosion and chemical resistance properties.
- Vinyl ester resin has also application in semiconductor and chip encapsulation due to its heat resistance properties. Growth of display panel market has augmented the demand of display driver chips.
- As per CINNO survey, APAC demand of display driver chips in 2020 is valued around 6 billion which is 8.7% rise from 2019 value. Moreover, demand for smartphone driver chips valued around 1.2 billion in 2020.

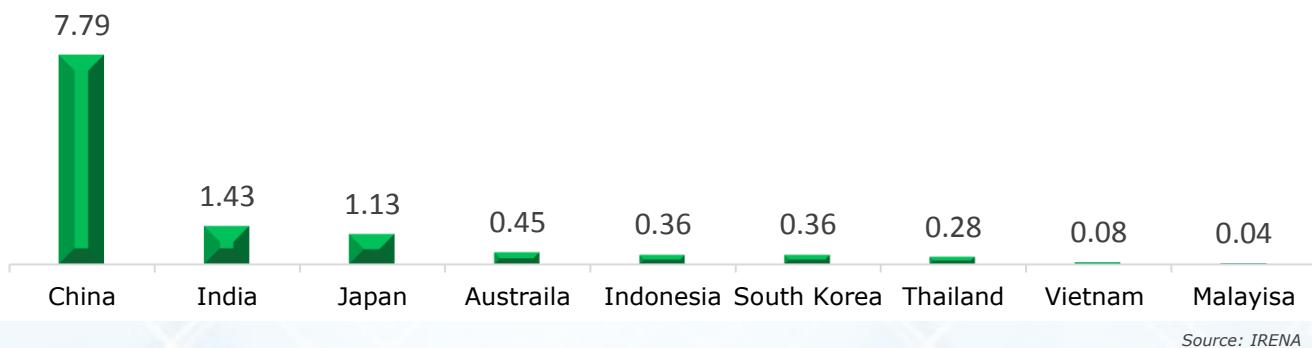
LCD Smartphone display driver chips vendor shipment share, 2020



Source: CINNO

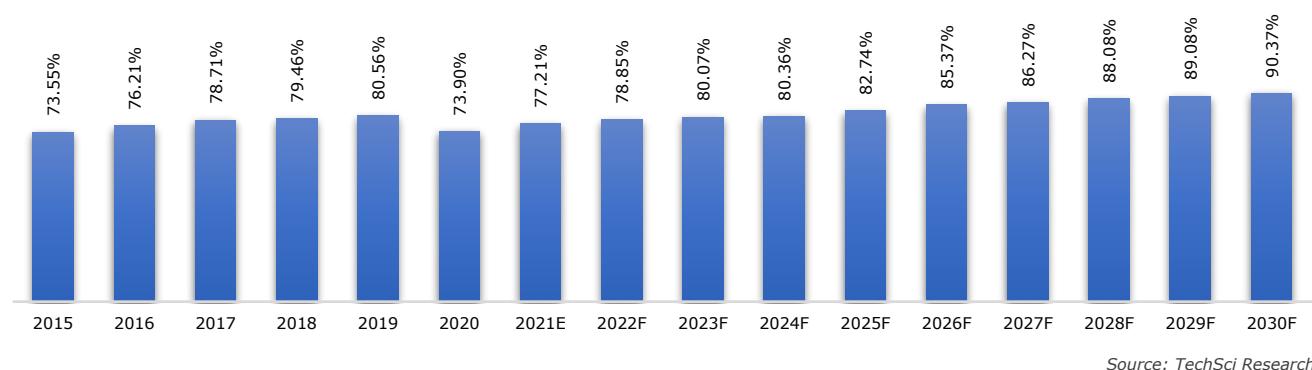
Renewable energy Consumption in Asia-Pacific region in 2020, By Country (In exajoules)

China holds largest share of renewable energy consumption in Asia Pacific region led by increasing investments into development of renewable energy. China's consumption of renewable energy is approximately 8 exajoules in 2020. India and Japan are also significantly increasing investments into building energy infrastructure such as solar energy and wind energy.



3.2.1.2. Operating Efficiency

Asia Pacific Vinyl Ester Resin Operating Efficiency (Percentage), 2015-2030F



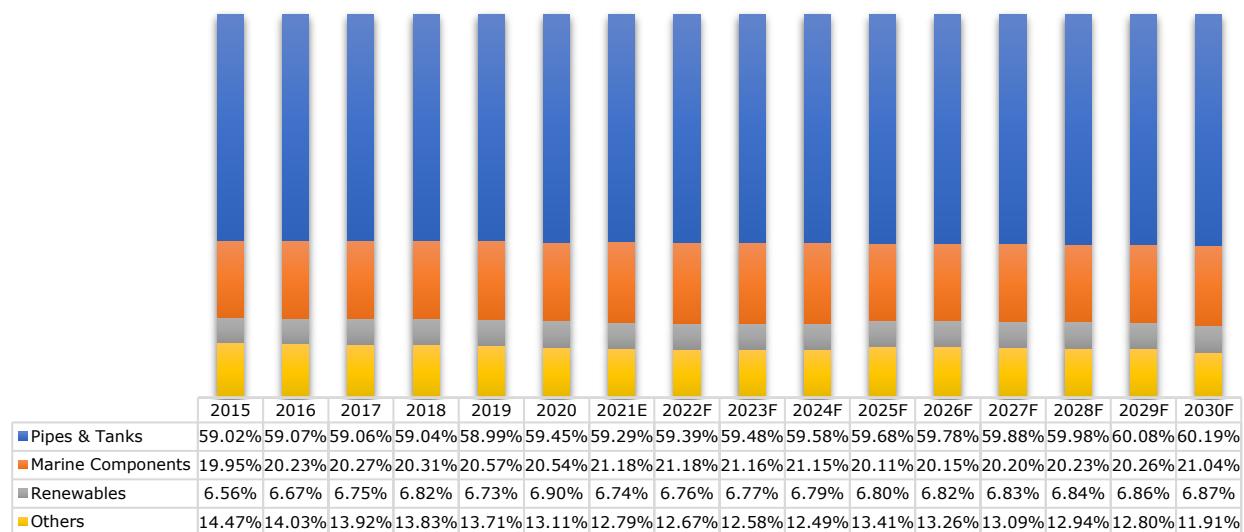
Real GDP Growth Forecast for Major Economies in APAC Region

Country	2023	2025
India	7.67%	7.42%
China	5.75%	5.60%
Japan	1.26%	0.72%
South Korea	2.45%	3.44%
World	3.84%	3.56%

Source: IMF, World Bank

3.2.1.3. Demand By Application

Asia Pacific Vinyl Ester Resin Demand, By Application, By Volume (000' Tonnes), 2015–2030F



Others include Defense, Aerospace, Electrical and electronics etc.

Source: TechSci Research

Demand by Application (000' Tonnes)	2015	2016	2017	2018	2019	2020	2021E	2025F	2030F
Pipes & Tanks	167	178	187	196	206	192	207	289	414
Marine Components	57	61	64	68	72	66	74	97	145
Renewables	19	20	21	23	23	22	24	33	47
Others	41	42	44	46	48	42	45	65	82
Total	283	301	317	333	349	322	349	485	688

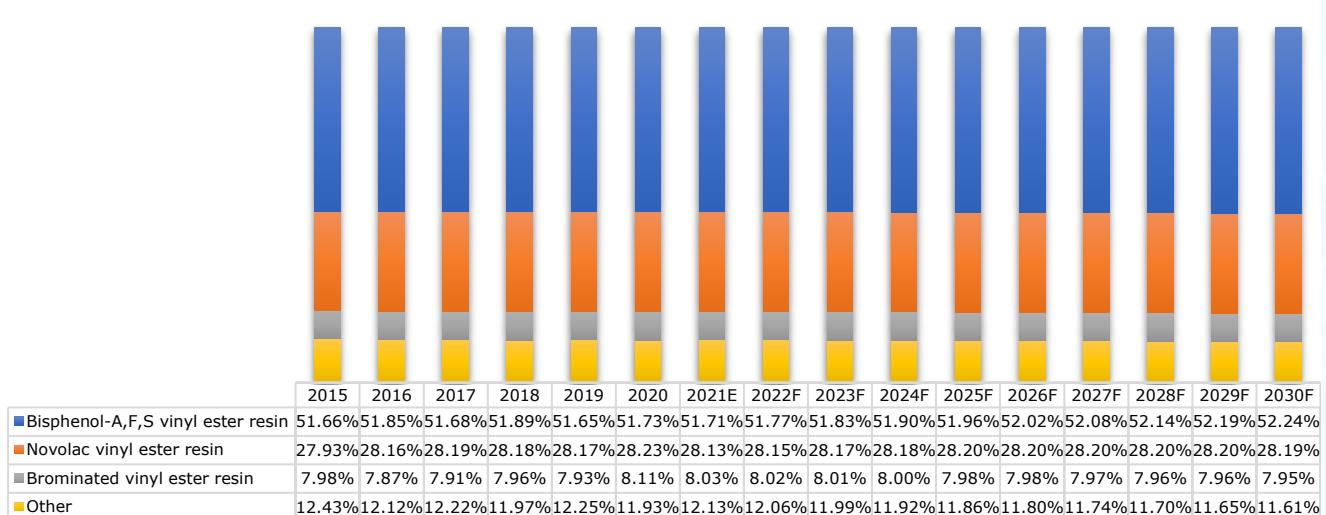
Others include Défense, Aerospace, Electrical and electronics etc.

Source: TechSci Research

- The APAC region will be noticing huge investment in renewable energy sector like wind and solar energy further increasing the market for the product.
- Increasing industrialization and rising investments in defense sector has further increased the market for vinyl ester.
- The use of vinyl ester resin in electrical & electronics industry in China due to established industry in the country also stimulated the demand in the region.

3.2.1.4. Demand By Type

Asia Pacific Vinyl Ester Resin Demand, By Type, By Volume (000' Tonnes), 2015–2030F



Others include Urethane Modified vinyl ester resin, Elastomer Modified vinyl ester resin, etc.

Source: TechSci Research

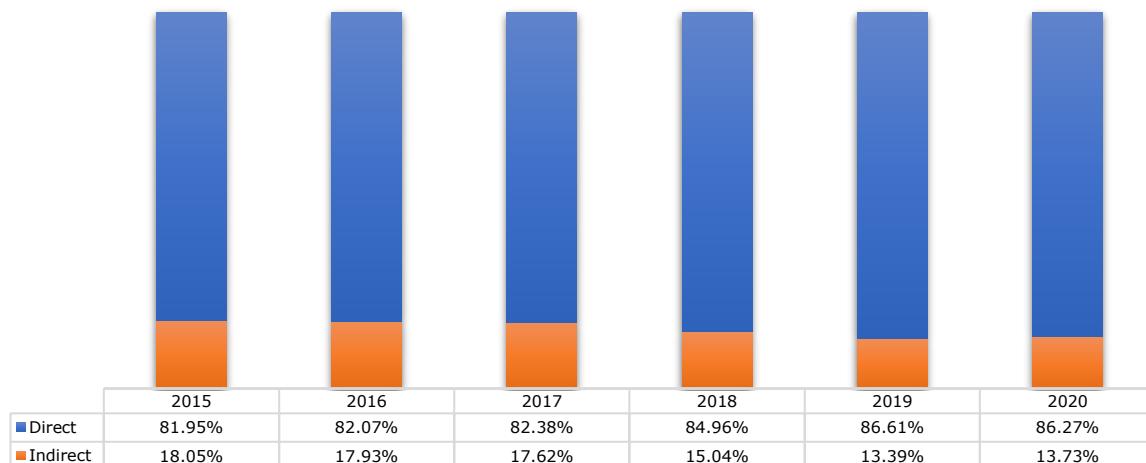
Demand by Type (000' Tonnes)	2015	2016	2017	2018	2019	2020	2021E	2025F	2030F
Bisphenol-A,F,S vinyl ester resin	146	156	164	173	180	167	181	252	360
Novolac vinyl ester resin	79	85	89	94	98	91	98	137	194
Brominated vinyl ester resin	23	24	25	26	28	26	28	39	55
Other chemistry	35	36	39	40	43	38	42	57	80
Total	283	301	317	333	349	322	349	485	688

Others include Urethane Modified vinyl ester resin, Elastomer Modified vinyl ester resin, etc.

Source: TechSci Research

3.2.1.5. Demand By Sales Channel

Asia Pacific Vinyl Ester Resin Demand, By Sales Channel, By Volume (000' Tonnes), 2015–2020



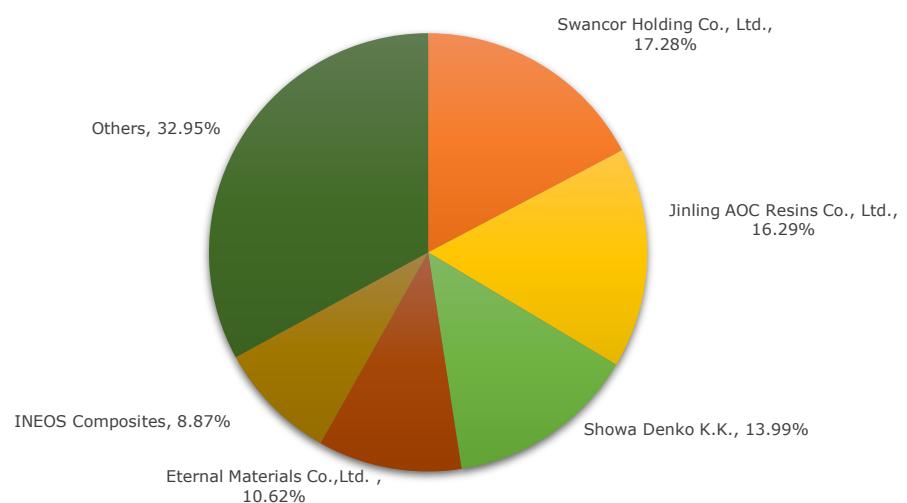
Source: TechSci Research

Demand by Sales Channel (000' Tonnes)	2015	2016	2017	2018	2019	2020	2021E
Direct	232	247	261	283	302	278	232
Indirect	51	54	56	50	47	44	51
Total	283	301	317	333	349	322	283

Source: TechSci Research

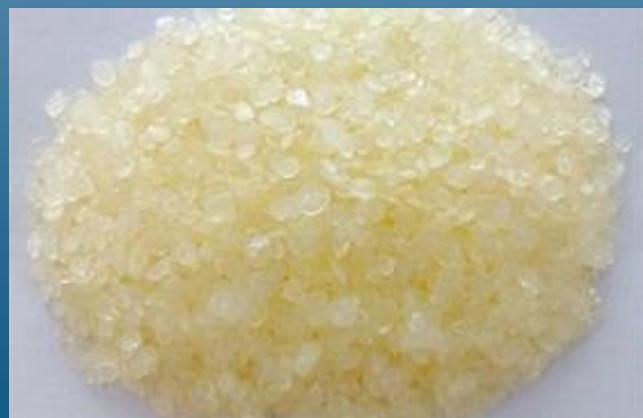
3.2.1.6. Sales By Company

Asia Pacific Vinyl Ester Resin Sales, By Company, By Volume (000' Tonnes), 2020

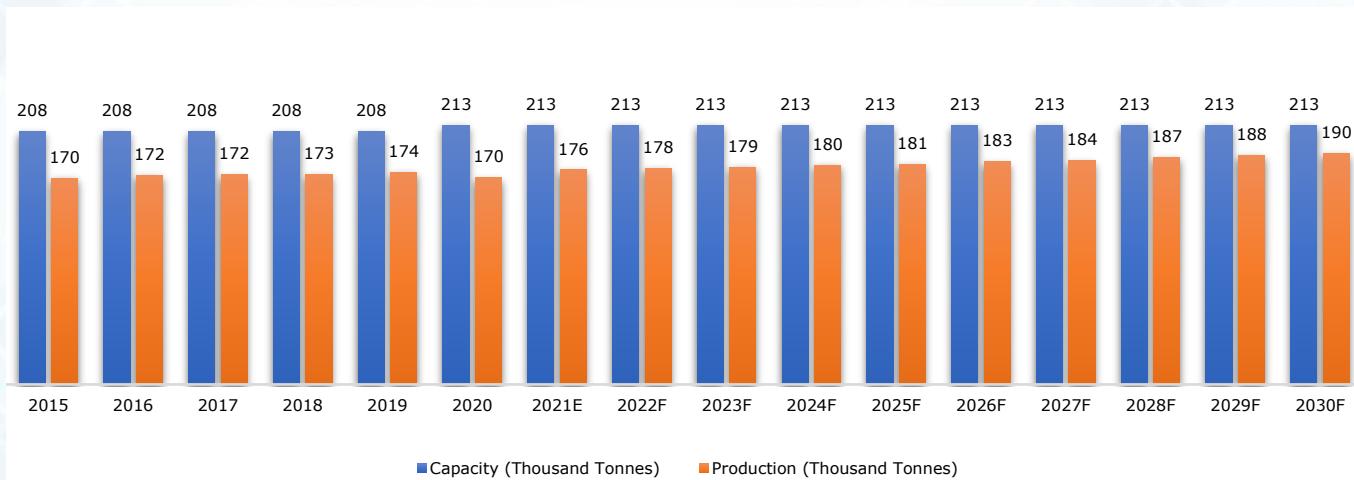


Source: TechSci Research

EUROPE VINYL ESTER RESIN DEMAND SUPPLY OUTLOOK



Europe Vinyl Ester Resin Capacity & Production, By Volume, 2015 - 2030F (000' Tonnes)



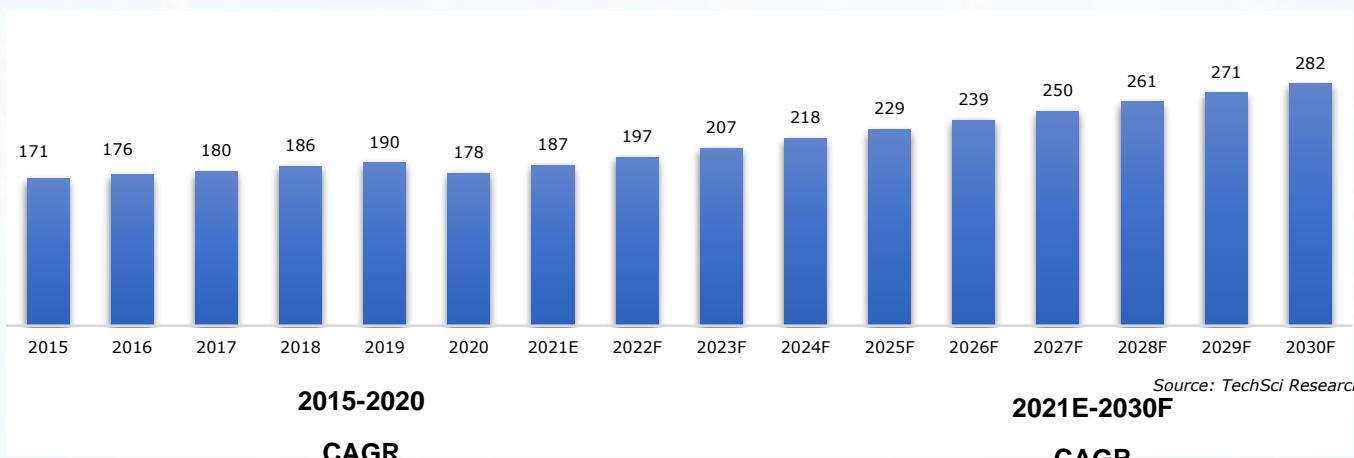
Source: TechSci Research

Company (000' Tonnes)	2015	2020	2030F
INEOS Composites	0	30	30
Hexion Inc.	30	30	30
Allnex group	20	20	20
Reinhold GmbH	20	20	20
Scott Bader Company Ltd.	20	20	20
Others	118	93	93
Total	208	213	213

Source: TechSci Research

3.2.3. Europe Vinyl Ester Resin Demand Supply Outlook

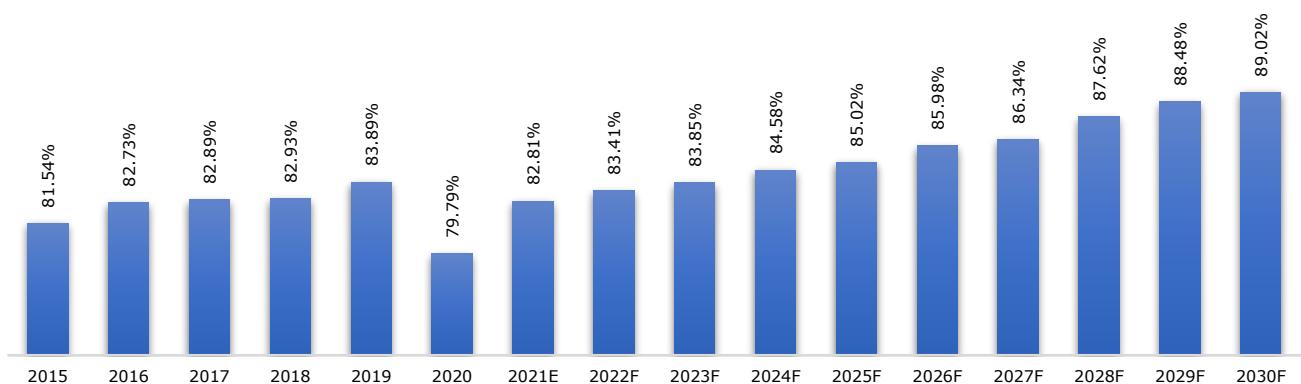
Europe Vinyl Ester Resin Demand, By Volume (000' Tonnes), 2015–2030F



- Substantial increase in wind energy installation, marine components production and defense project allocation coupled with stable lending rate is contributing to the rapid growth in the sales of vinyl ester resin in Europe.
- Product availability, flexibility and convenience are other major factors propelling the demand. Furthermore, with technological advancements, and product innovations is also continuously increasing. Moreover, manufacturers are rapidly innovating their products with an aim of providing multi-functional features.
- Merger & acquisition activities are becoming prevalent in the market in Europe. For Instance, in 2019, Ineos Composite completed the acquisition of the Ashland Composites polymer business. The company sells the product under the brand name of Derakane, Hetron, Arotran and Signia.

3.2.3.2. Operating Efficiency

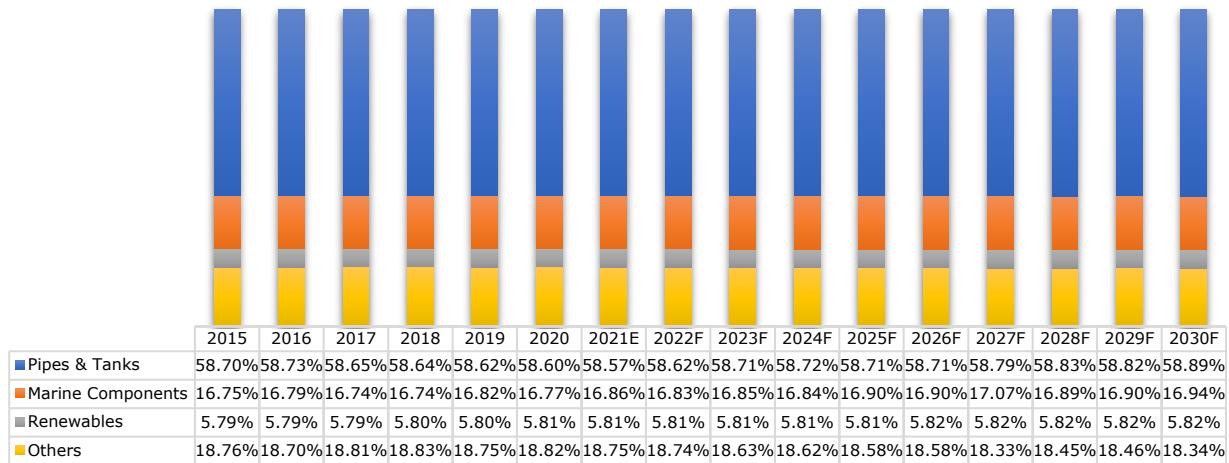
Europe Vinyl Ester Resin Operating Efficiency (Percentage), 2015-2030F



Source: TechSci Research

3.2.3.3. Demand By Application

Europe Vinyl Ester Resin Demand, By Application, By Volume (000' Tonnes), 2015–2030F



Others include Défense, Aerospace, Electrical and electronics etc.

Source: TechSci Research

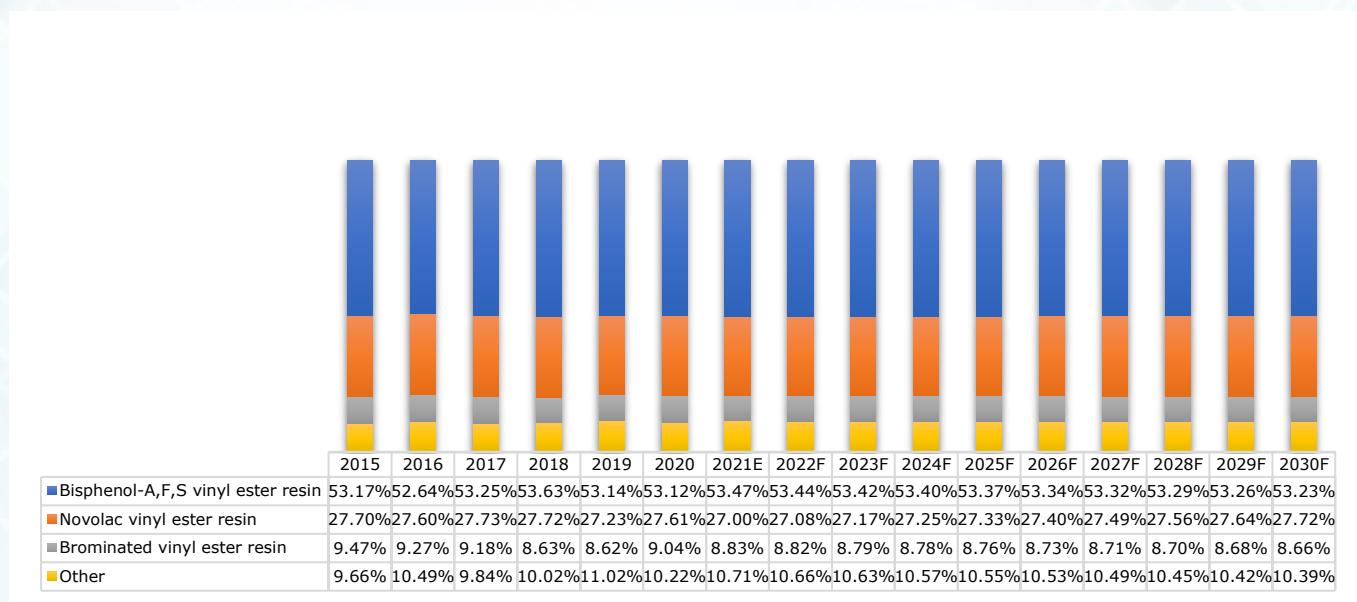
Demand by Application (000' Tonnes)	2015	2016	2017	2018	2019	2020	2021E	2025F	2030F
Pipes & Tanks	100	103	105	109	111	104	110	134	166
Marine Components	29	30	30	31	32	30	32	39	48
Renewables	10	10	10	11	11	10	11	13	16
Others	32	33	34	35	36	33	35	42	52
Total	171	176	180	186	190	178	187	229	282

Others include Défense, Aerospace, Electrical and electronics etc.

Source: TechSci Research

3.2.3.4. Demand By Type

Europe Vinyl Ester Resin Demand, By Type, By Volume (000' Tonnes), 2015–2030F



Source: TechSci Research

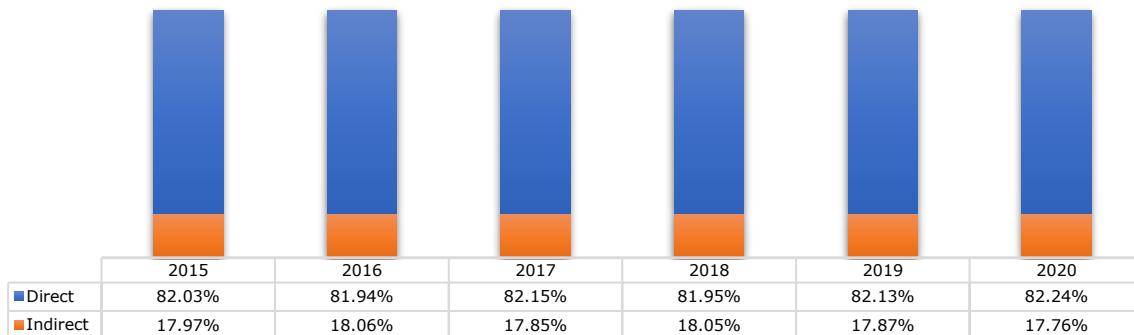
Demand by Type (000' Tonnes)	2015	2016	2017	2018	2019	2020	2021E	2025F	2030F
Bisphenol-A,F,S vinyl ester resin	91	93	96	100	101	94	100	122	150
Novolac vinyl ester resin	47	49	50	51	52	49	51	62	78
Brominated vinyl ester resin	16	16	16	16	16	16	17	20	24
Other chemistry	17	18	18	19	21	18	20	24	29
Total	171	176	180	186	190	178	187	229	282

Others include Urethane Modified vinyl ester resin, Elastomer Modified vinyl ester resin etc.

Source: TechSci Research

3.2.3.5. Demand By Sales Channel

Europe Vinyl Ester Resin Demand, By Sales Channel, By Volume (000' Tonnes), 2015–2020



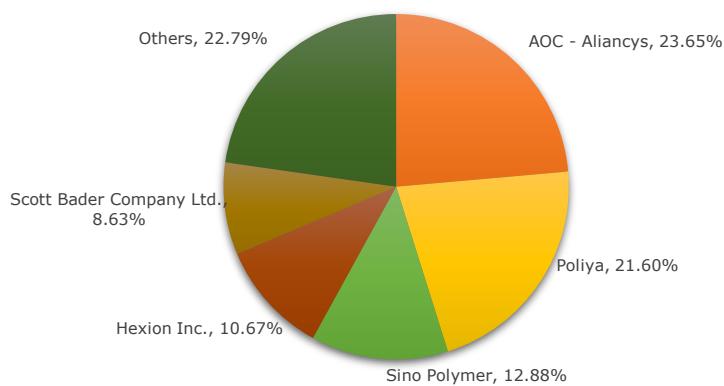
Source: TechSci Research

Demand by Sales Channel (000' Tonnes)	2015	2016	2017	2018	2019	2020	2021E
Direct	140	144	148	152	156	146	140
Indirect	31	32	32	34	34	32	31
Total	171	176	180	186	190	178	171

Source: TechSci Research

3.2.3.6. Sales By Company

Europe Vinyl Ester Resin Sales, By Company, By Volume (000' Tonnes), 2020



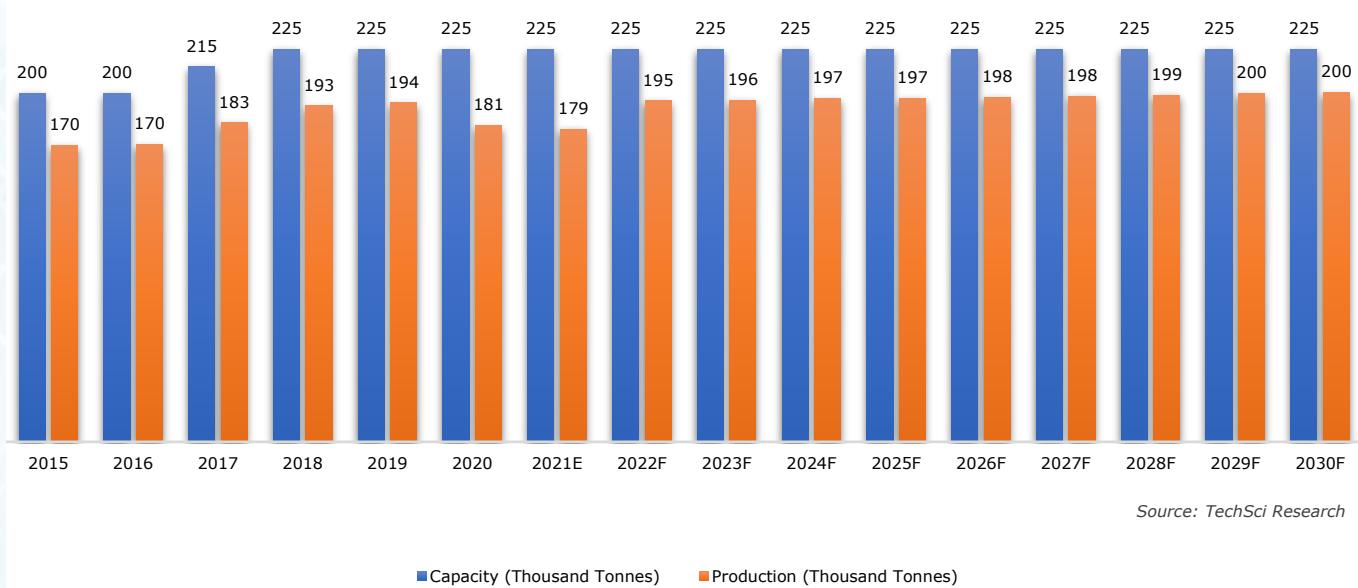
Others include Polytnt S.p.A., Reinhold GmbH, Ashland Global Holdings Inc., Allnex group, etc.

Source: TechSci Research

NORTH AMERICA VINYL ESTER RESIN DEMAND SUPPLY OUTLOOK



North America Vinyl Ester Resin Capacity & Production, By Volume (000' Tonnes), 2015 - 2030F (Thousand Tonnes)

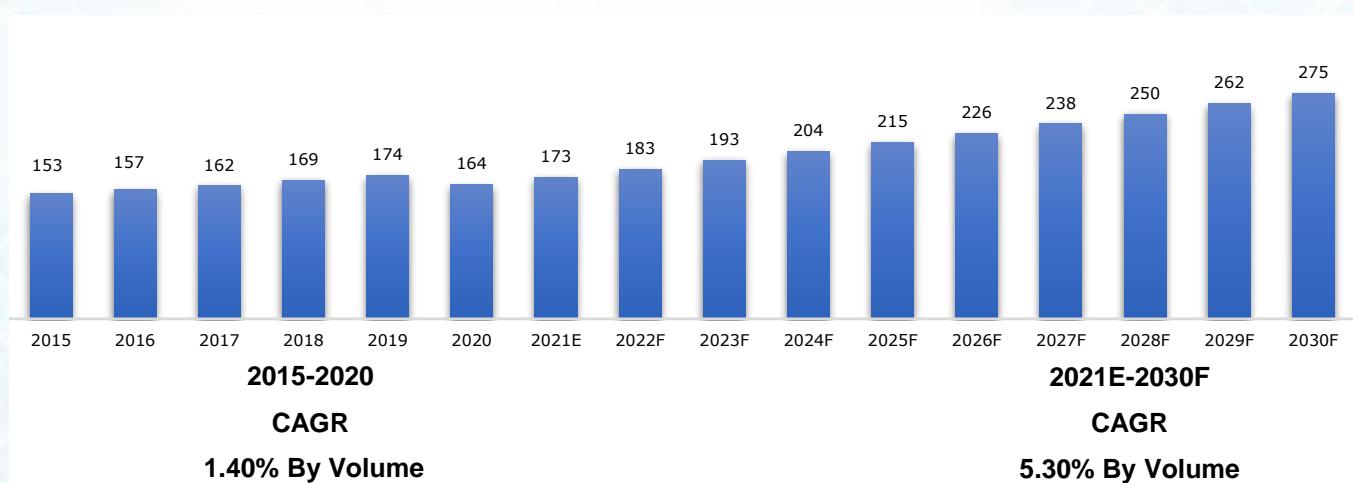


Company (000' Tonnes)	2015	2020	2030F
AOC - Aliancys	60	70	70
Polynt-Reichhold	35	45	45
INEOS Composites	0	35	35
Interplastic Corporation	20	20	20
Ashland Global Holdings Inc.	30	0	0
Others	55	55	55
Total	200	225	225

Source: TechSci Research

3.2.4. North America Vinyl Ester Resin Demand Supply Outlook

North America Vinyl Ester Resin Demand, By Volume (000' Tonnes), 2015–2030F

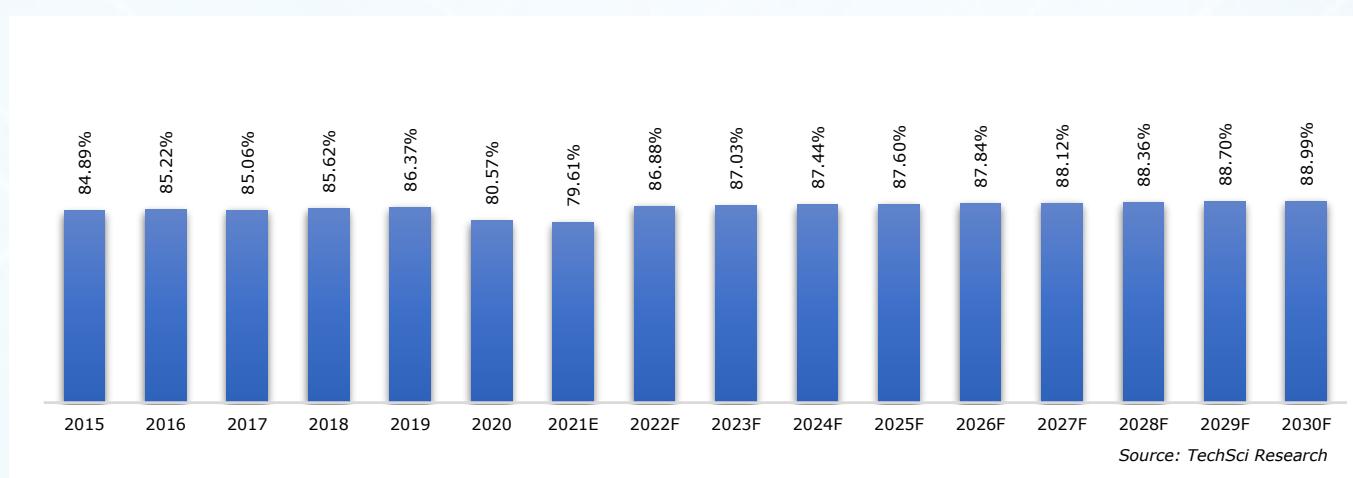


Source: TechSci Research

- This increase in demand is attributed to growing infrastructure projects and increasing investment in renewable energy sector.
- Several manufacturers are investing heavily in capacity expansion and new technology development to meet the growing demand for vinyl ester resin in the region.

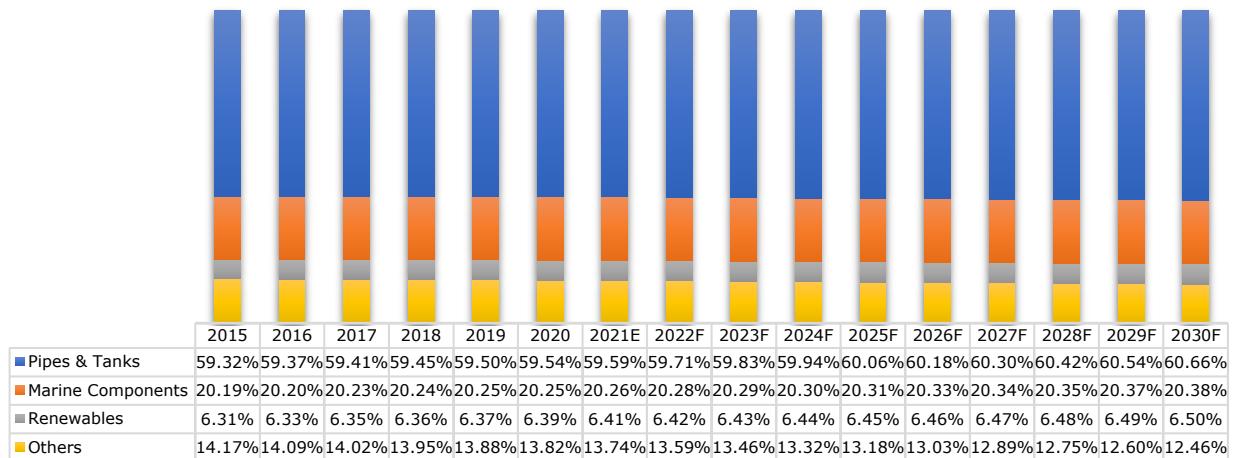
3.2.4.2. Operating Efficiency

North America Vinyl Ester Resin Operating Efficiency (Percentage), 2015-2030F



3.2.4.3. Demand By Application

North America Vinyl Ester Resin Demand, By Application, By Volume (000' Tonnes), 2015–2030F



Others include Défense, Aerospace, Electrical and electronics etc.

Source: TechSci Research

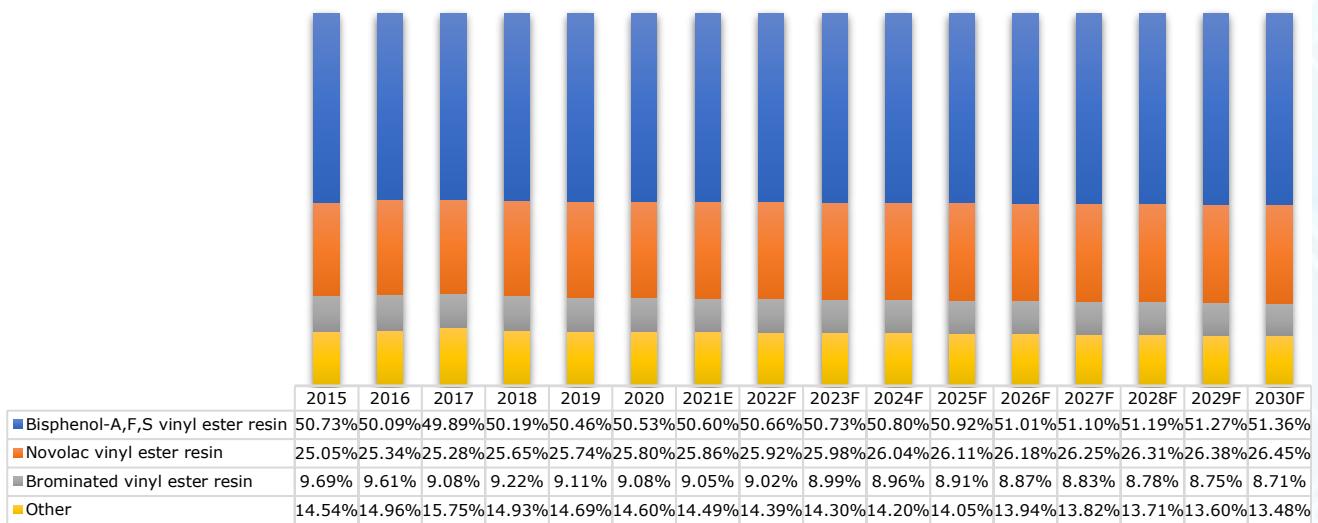
Demand by Application (000' Tonnes)	2015	2016	2017	2018	2019	2020	2021E	2025F	2030F
Pipes & Tanks	91	93	96	101	104	97	103	129	167
Marine Components	31	32	33	34	35	33	35	44	56
Renewables	10	10	10	11	11	10	11	14	18
Others	22	22	23	24	24	23	24	28	34
Total	153	157	162	169	174	164	173	215	275

Others include Défense, Aerospace, Electrical and electronics etc.

Source: TechSci Research

3.2.4.4. Demand By Type

North America Vinyl Ester Resin Demand, By Type, By Volume (000' Tonnes), 2015-2030F



Others include Urethane Modified vinyl ester resin, Elastomer Modified vinyl ester resin etc.

Source: TechSci Research

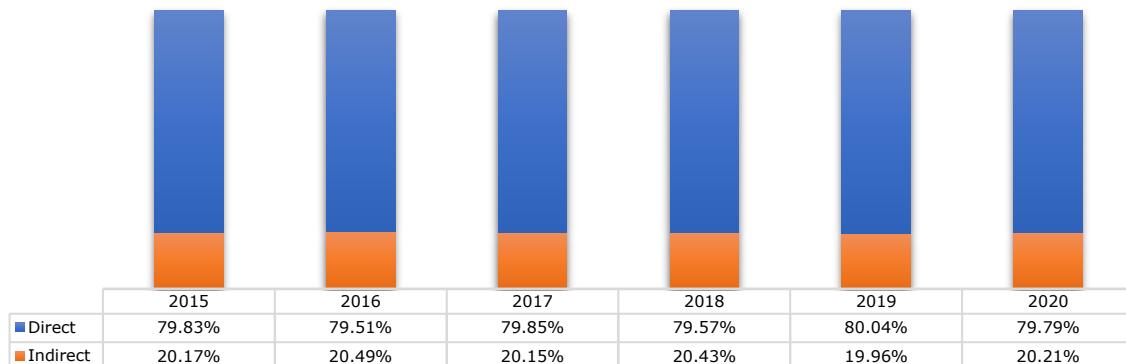
Demand by Type (000' Tonnes)	2015	2016	2017	2018	2019	2020	2021E	2025F	2030F
Bisphenol-A,F,S vinyl ester resin	77	79	81	85	88	83	87	109	141
Novolac vinyl ester resin	38	40	41	43	45	42	45	56	73
Brominated vinyl ester resin	15	15	15	16	16	15	16	19	24
Other chemistry	22	24	26	25	26	24	25	30	37
Total	153	157	162	169	174	164	173	215	275

Others include Urethane Modified vinyl ester resin, Elastomer Modified vinyl ester resin etc.

Source: TechSci Research

3.2.4.5. Demand By Sales Channel

**North America Vinyl Ester Resin Demand, By Sales Channel, By Volume (000' Tonnes),
2015–2020**



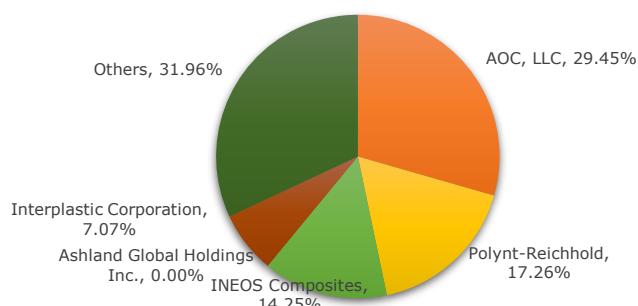
Source: TechSci Research

Demand by Sales Channel (000' Tonnes)	2015	2016	2017	2018	2019	2020	2021E
Direct	122	125	129	135	140	130	122
Indirect	31	32	33	35	35	33	31
Total	153	157	162	169	174	164	153

Source: TechSci Research

3.2.4.6. Sales By Company

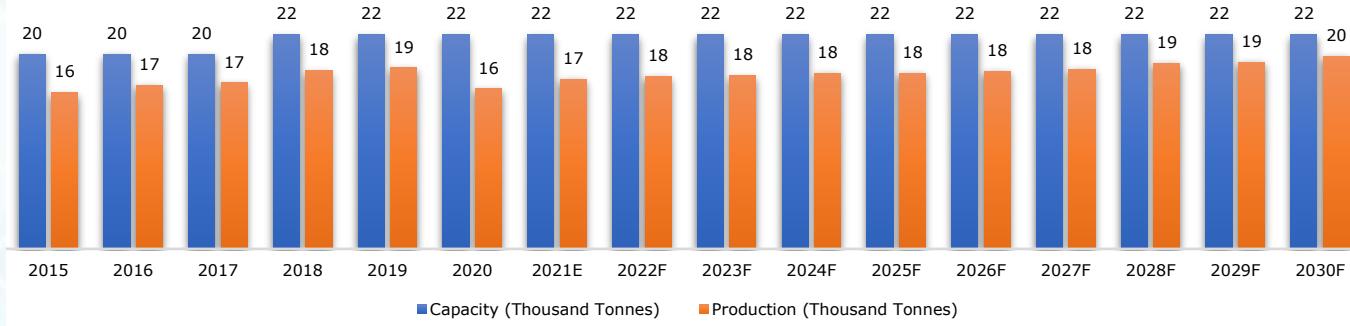
North America Vinyl Ester Resin Sales, By Company, By Volume (000' Tonnes), 2020



SOUTH AMERICA VINYL ESTER RESIN MARKET OUTLOOK



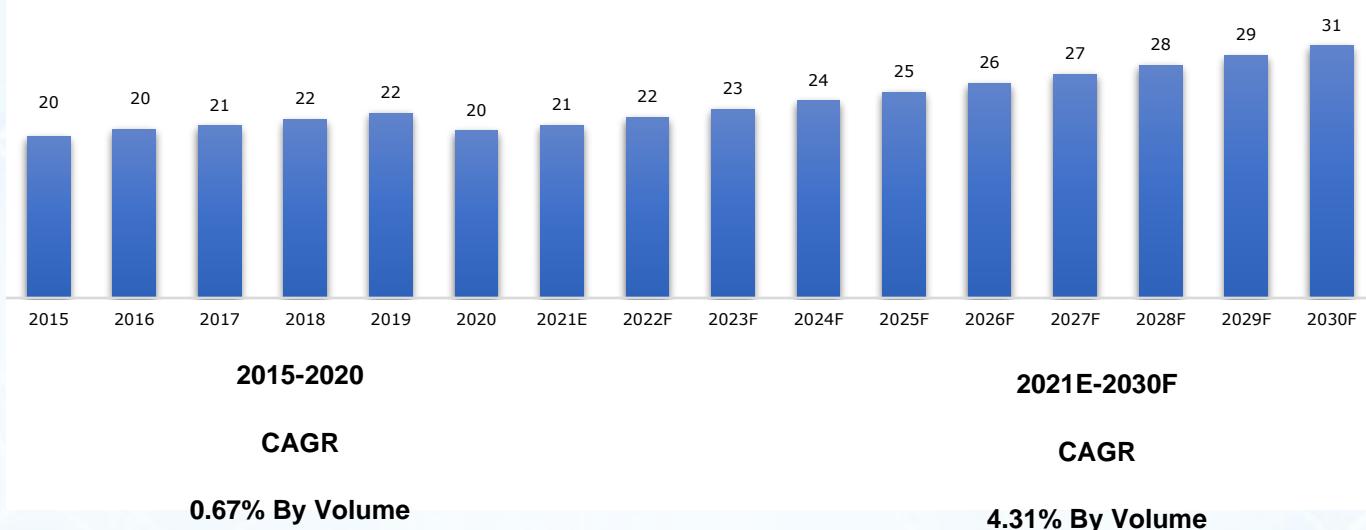
South America Vinyl Ester Resin Capacity & Production, By Volume (000' Tonnes), 2015 - 2030F



Source: TechSci Research

3.2.5. South America Vinyl Ester Resin Demand Supply Outlook

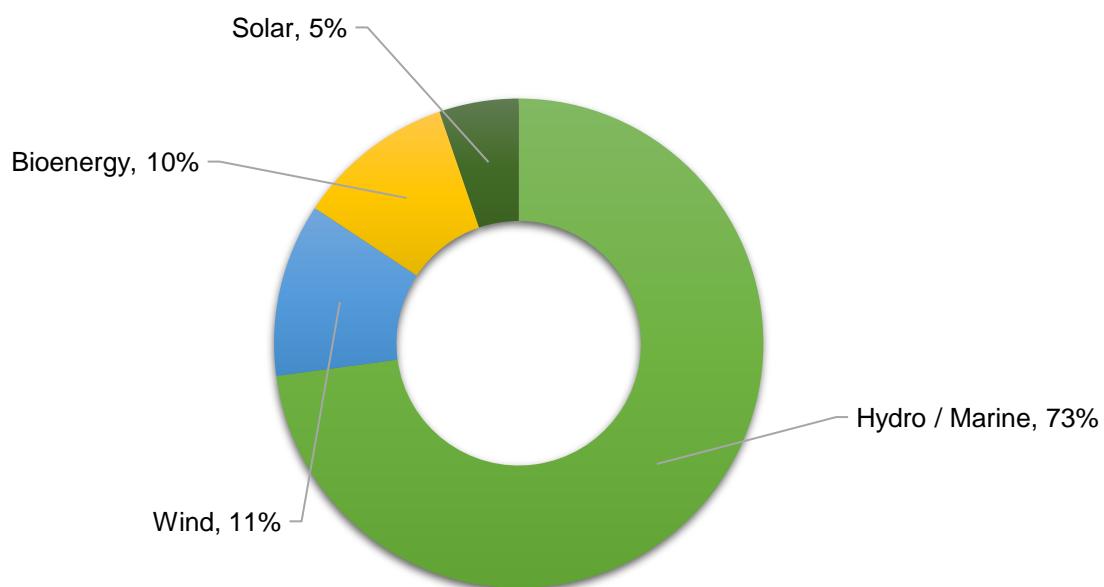
South America Vinyl Ester Resin Demand, By Volume (000' Tonnes), 2015–2030F



Source: TechSci Research

- This increase in demand is led by strong demand growth in fiber reinforced plastics (FRP), marine components and wind energy sector.
- Rising industrialization and urbanization have also contributed to the rising demand of the product in the region.
- The increase in demand in industrial applications where it is used as a lining system for water treatment, air pollution, chemical processing and mineral processing providing resistance from corrosion stimulated the market of vinyl ester resin in the region.

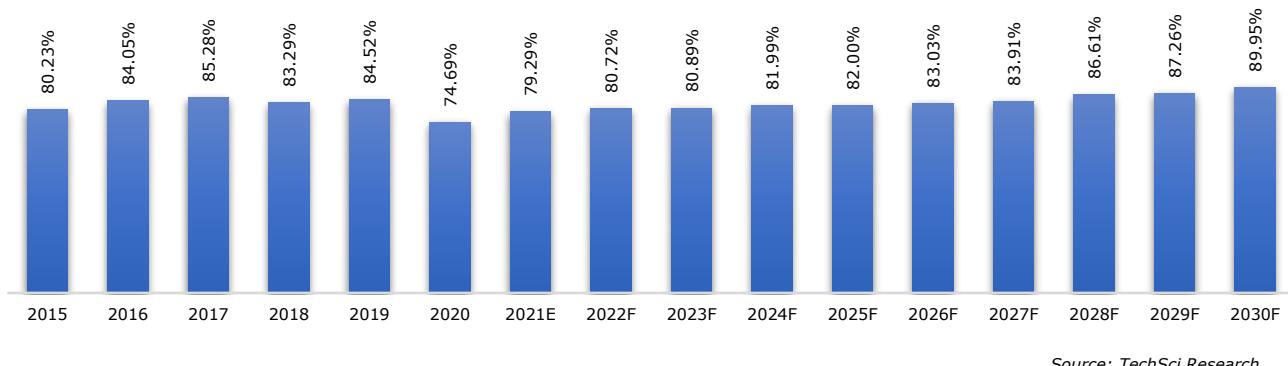
Brazil Renewable Energy Production Percentage Share, By types of Sources in 2020.



Source: TechSci Research

3.2.5.2. Operating Efficiency

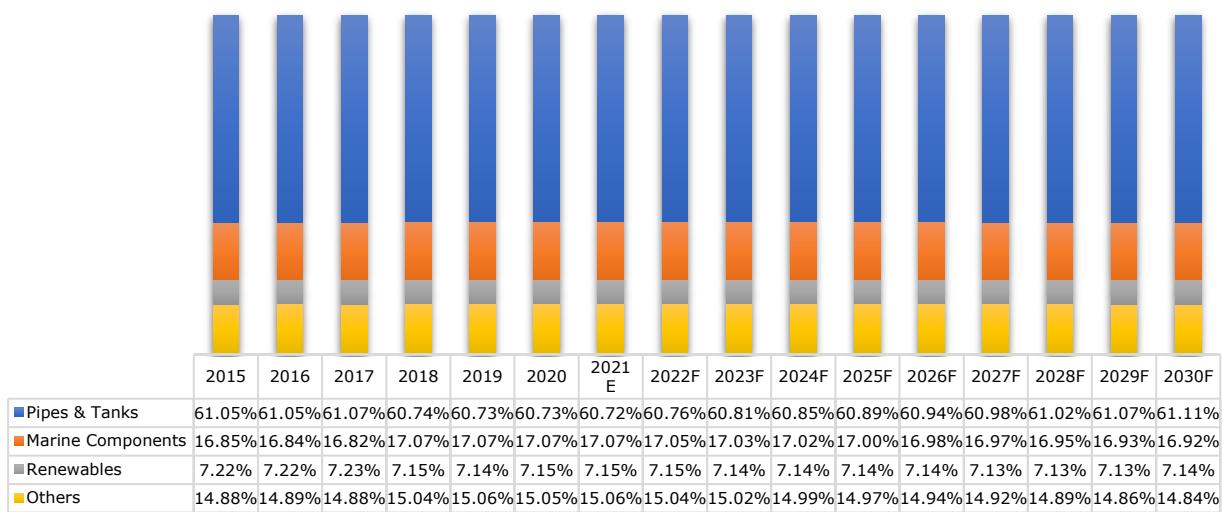
South America Vinyl Ester Resin Operating Efficiency (Percentage), 2015-2030F



Source: TechSci Research

3.2.5.3. Demand By Application

South America Vinyl Ester Resin Demand, By Application, By Volume (000' Tonnes), 2015–2030F



Others include Défense, Aerospace, Electrical and electronics etc.

Source: TechSci Research

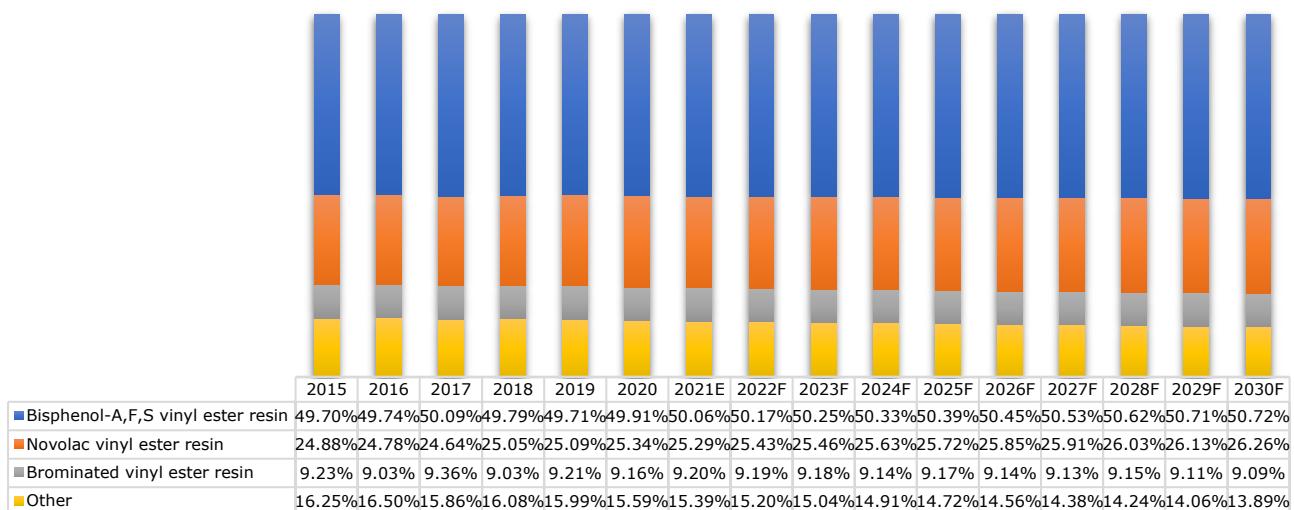
Demand by Application (000' Tonnes)	2015	2016	2017	2018	2019	2020	2021E	2025F	2030F
Pipes & Tanks	12	12	13	13	14	12	13	15	19
Marine Components	3	3	4	4	4	3	4	4	5
Renewables	1	1	2	2	2	1	1	2	2
Others	3	3	3	3	3	3	3	4	5
Total	20	20	21	22	22	20	21	25	31

Others include Défense, Aerospace, Electrical and electronics etc.

Source: TechSci Research

3.2.5.4. Demand By Type

South America Vinyl Ester Resin Demand, By Type, By Volume (000' Tonnes), 2015–2030F



Others include Urethane Modified vinyl ester resin, Elastomer Modified vinyl ester resin, etc.

Source: TechSci Research

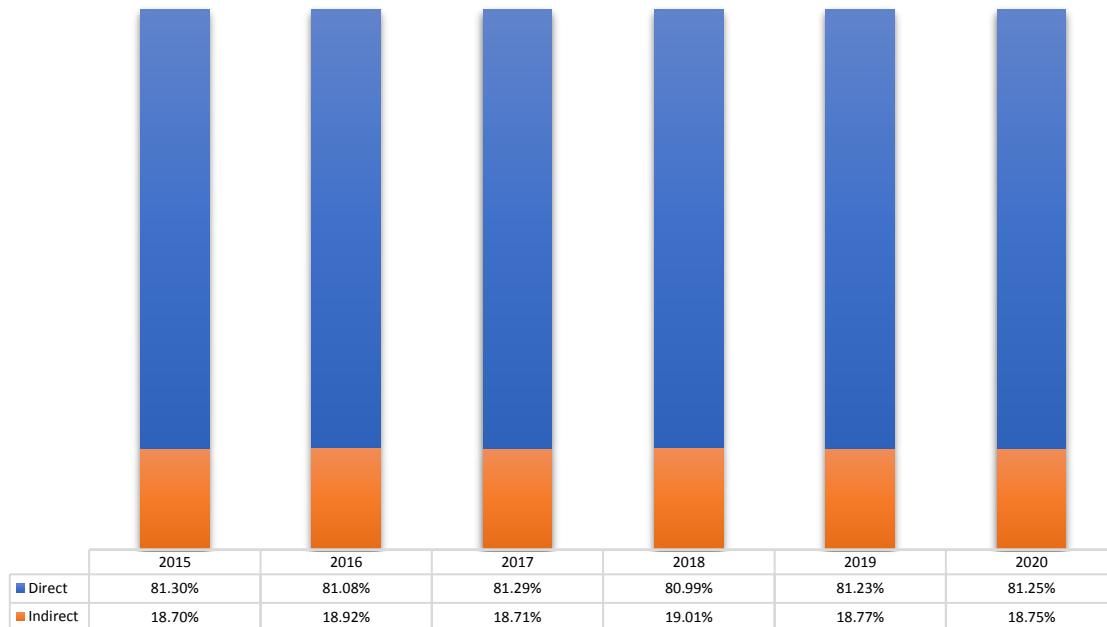
Demand by Type (000' Tonnes)	2015	2016	2017	2018	2019	2020	2021E	2025F	2030F
Bisphenol-A,F,S vinyl ester resin	10	10	10	11	11	10	10	13	16
Novolac vinyl ester resin	5	5	5	5	6	5	5	6	8
Brominated vinyl ester resin	2	2	2	2	2	2	2	2	3
Other chemistry	3	3	3	3	4	3	3	4	4
Total	20	20	21	22	22	20	21	25	31

Others include Urethane Modified vinyl ester resin, Elastomer Modified vinyl ester resin, etc.

Source: TechSci Research

3.2.5.5. Demand By Sales Channel

South America Vinyl Ester Resin Market Share, By Sales Channel, By Volume (000' Tonnes), 2015–2020



Source: TechSci Research

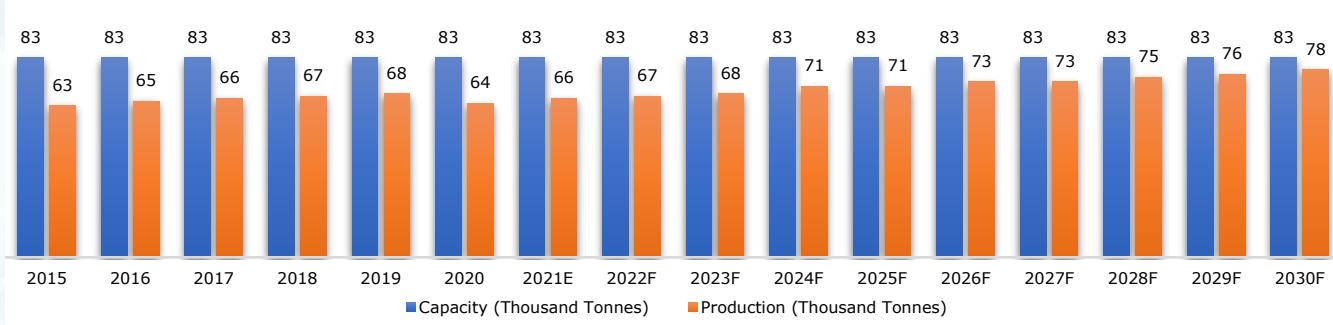
Demand by Sales Channel (000' Tonnes)	2015	2016	2017	2018	2019	2020	2021E
Direct	16	17	17	18	18	16	16
Indirect	4	4	4	4	4	4	4
Total	20	20	21	22	22	20	20

Source: TechSci Research

MIDDLE EAST & AFRICA VINYL ESTER RESIN MARKET OUTLOOK



Middle East & Africa Vinyl Ester Resin Capacity & Production, By Volume (000' Tonnes), 2015 - 2030F



Source: TechSci Research

Major Demand Drivers of Vinyl Ester Resin During Forecast Period

➤ Increasing Desalination Construction Projects

GCC nations have limited water resources due to which these countries rely heavily on desalination plants. Due to growing population, GCC nation plans to construct more desalination projects such as Shuaibah IWPP, Ras Abu Fontas A3 project, etc. Countries such as Saudi Arabia plan to invest USD24.30 billion in desalination projects by 2026. These desalination plants are projected to drive need for FRP pipes and tanks.

➤ Smart Cities Development

A smart city adopts high-end technological infrastructure incorporating comprehensive IT infrastructure, a network of sensors, cameras, wireless devices, and data centers for the effective delivery of essential services such as electricity, water supply, sanitation, etc. The vinyl ester resin manufacturers will benefit from smart city projects. In April 2017, Saudi Arabia announced an investment of USD70 billion for the development of four new “Economic Cities” on the concept of smart cities by 2030, with an aim to diversify its economy from hydrocarbon sector to other commercial sectors.

➤ Growth in Infrastructure Projects

GCC nations are boosting their infrastructure by investing heavily on development of railway, roadways, and seaports. Various metro projects have been initiated across different cities in GCC countries such as Jeddah Metro, Kuwait Metro, Doha Metro, Dubai Metro, etc. Development of railway network is projected to lead to the deployment of overhead railway lines and thus drive demand for unsaturated polyester resin including vinyl ester resin in the GCC region.

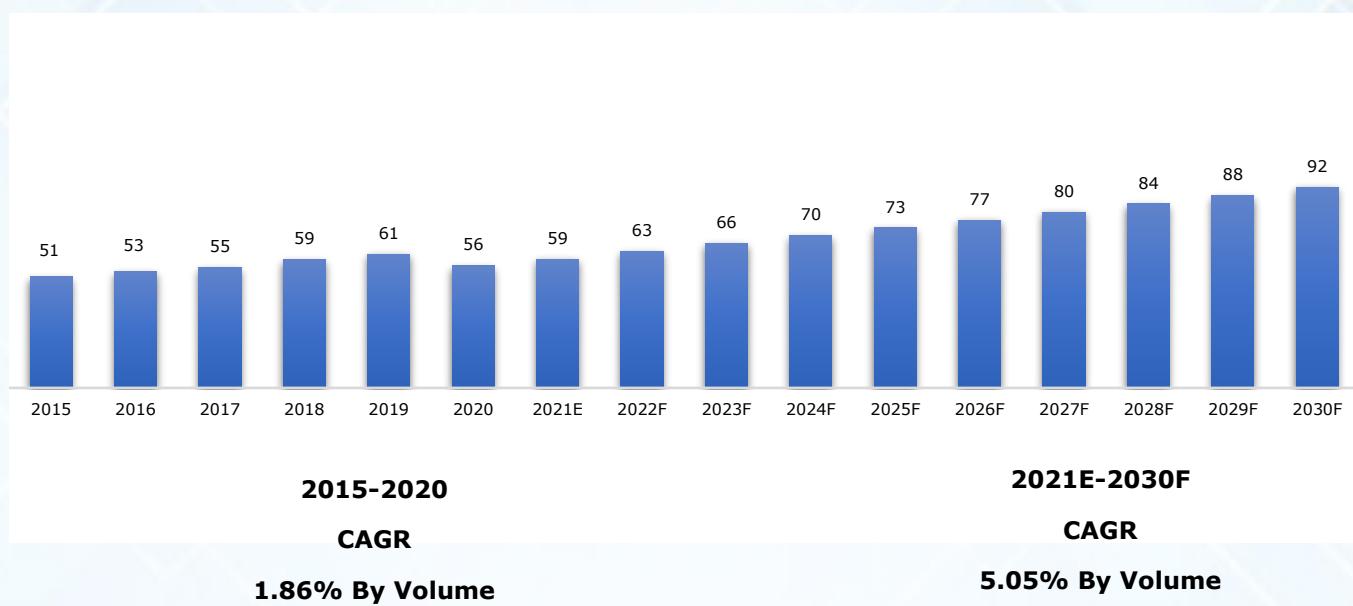
Major Infrastructure and Industrial Projects in GCC Region under Planning or Execution, By Value, By 2020 (USD Million)

Activity	Saudi Arabia	UAE	Kuwait	Qatar	Oman	Bahrain
Chemical	64,916	24,809	565	1,484	15,450	5,000
Construction	475,218	539,793	80,080	139,843	43,160	30,967
Gas	25,402	21,083	11,848	12,889	25,712	1,258
Industrial	28,717	8,996	250	970	12,179	4,656
Oil	23,409	50,899	55,188	16,559	14,659	5,025
Power	332,305	35,055	29,019	8,785	9,039	6,148
Transport	217,569	99,226	46,876	103,083	36,506	11,050
Water	36,035	6,253	8,732	16,098	6,860	1,778

Source: TechSci Research

3.2.6. Middle East & Africa Vinyl Ester Resin Demand Supply Outlook

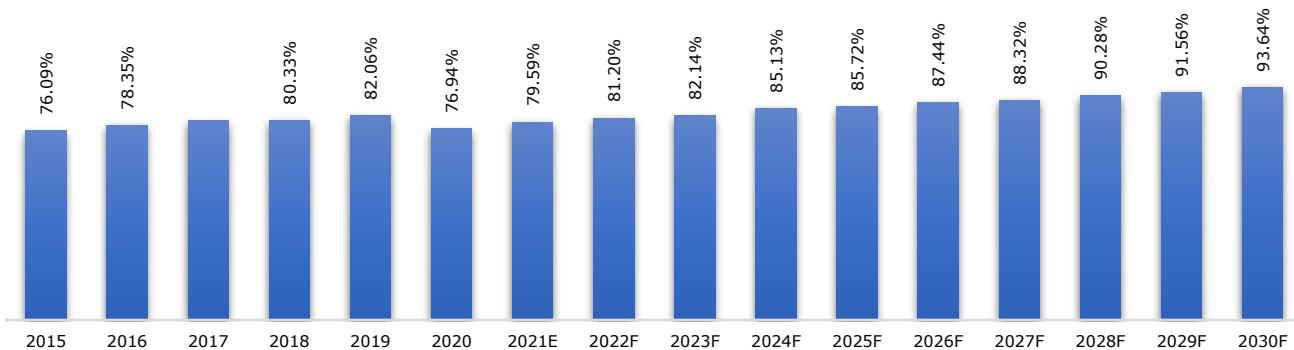
Middle East & Africa Vinyl Ester Resin Demand, By Volume (000' Tonnes), 2015–2030F



Source: TechSci Research

3.2.6.2. Operating Efficiency

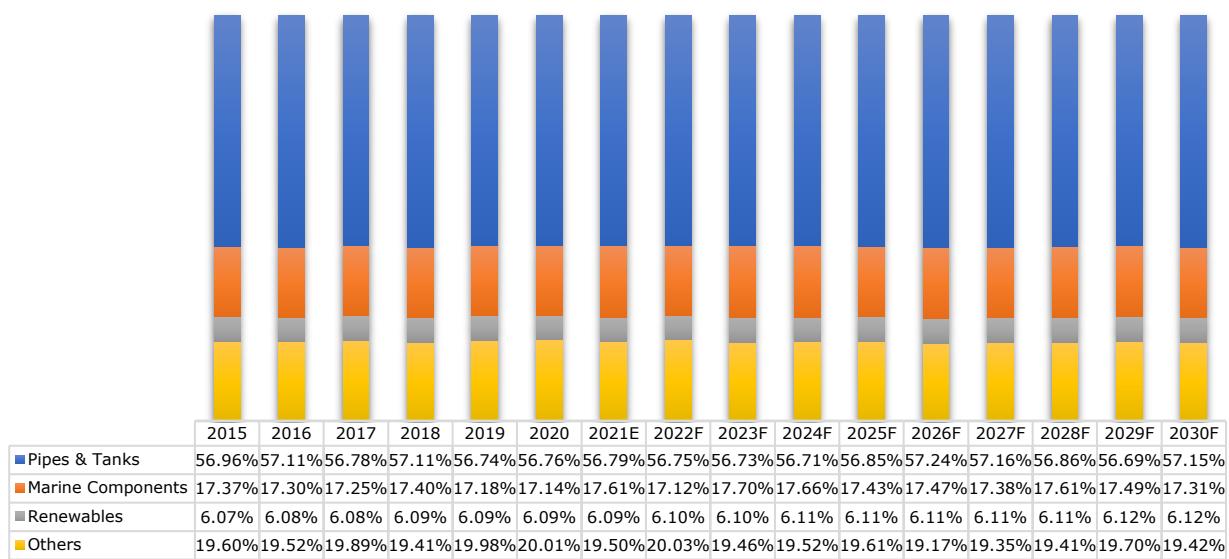
Middle East & Africa Vinyl Ester Resin Operating Efficiency (Percentage), 2015-2030F



Source: TechSci Research

3.2.6.3. Demand By Application

Figure 45: Middle East & Africa Vinyl Ester Resin Demand, By Application, By Volume (000' Tonnes), 2015–2030F



Others include Défense, Aerospace, Electrical and electronics etc.

Source: TechSci Research

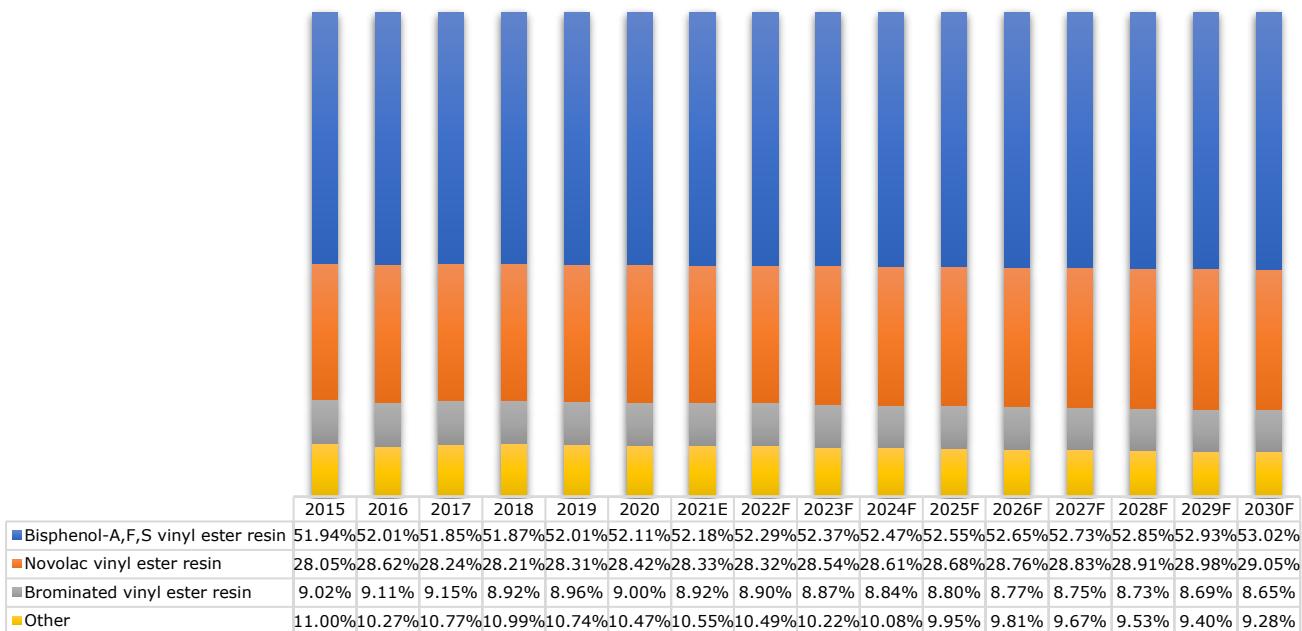
Demand by Application (000' Tonnes)	2015	2016	2017	2018	2019	2020	2021E	2025F	2030F
Pipes & Tanks	29	30	31	33	35	32	33	42	52
Marine Components	9	9	9	10	10	10	10	13	16
Renewables	3	3	3	4	4	3	4	4	6
Others	10	10	11	11	12	11	11	14	18
Total	51	53	55	59	61	56	59	73	92

Others include Défense, Aerospace, Electrical and electronics etc.

Source: TechSci Research

3.2.6.4. Demand By Type

Figure 46: Middle East & Africa Vinyl Ester Resin Demand, By Type, By Volume (000' Tonnes), 2015–2030F



Source: TechSci Research

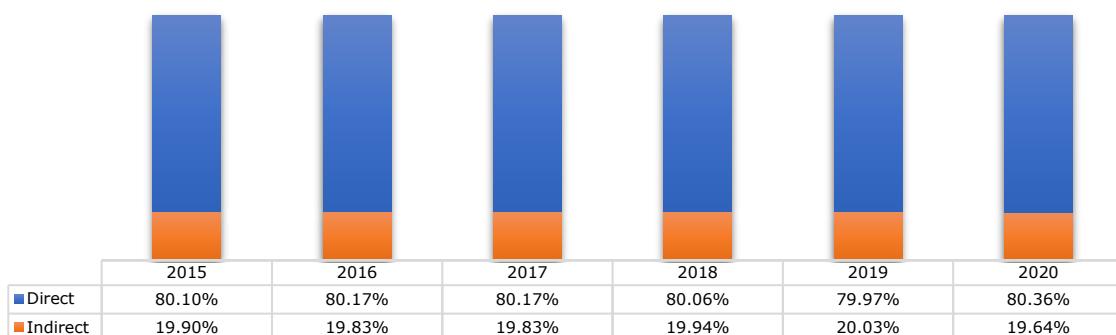
Demand by Type (000' Tonnes)	2015	2016	2017	2018	2019	2020	2021E	2025F	2030F
Bisphenol-A,F,S vinyl ester resin	26	28	28	30	32	29	31	38	49
Novolac vinyl ester resin	14	15	16	17	17	16	17	21	27
Brominated vinyl ester resin	5	5	5	5	5	5	5	6	8
Other chemistry	6	5	6	6	7	6	6	7	9
Total	51	53	55	59	61	56	59	73	92

Others include Urethane Modified vinyl ester resin, Elastomer Modified vinyl ester resin, etc.

Source: TechSci Research

3.2.6.5. Demand By Sales Channel

Figure 47: Middle East & Africa Vinyl Ester Resin Demand, By Sales Channel, By Volume (000' Tonnes), 2015–2020



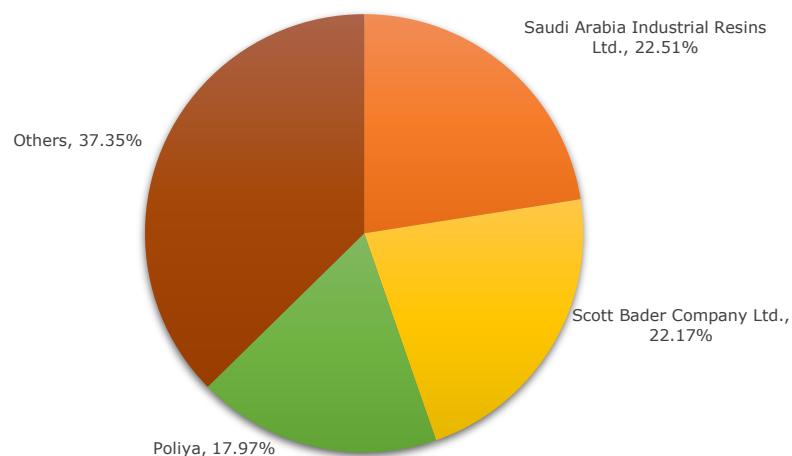
Source: TechSci Research

Demand by Sales Channel (000' Tonnes)	2015	2016	2017	2018	2019	2020	2021E
Direct	41	43	44	47	49	45	41
Indirect	10	11	11	12	12	11	10
Total	51	53	55	59	61	56	51

Source: TechSci Research

3.2.6.6. Sales By Company

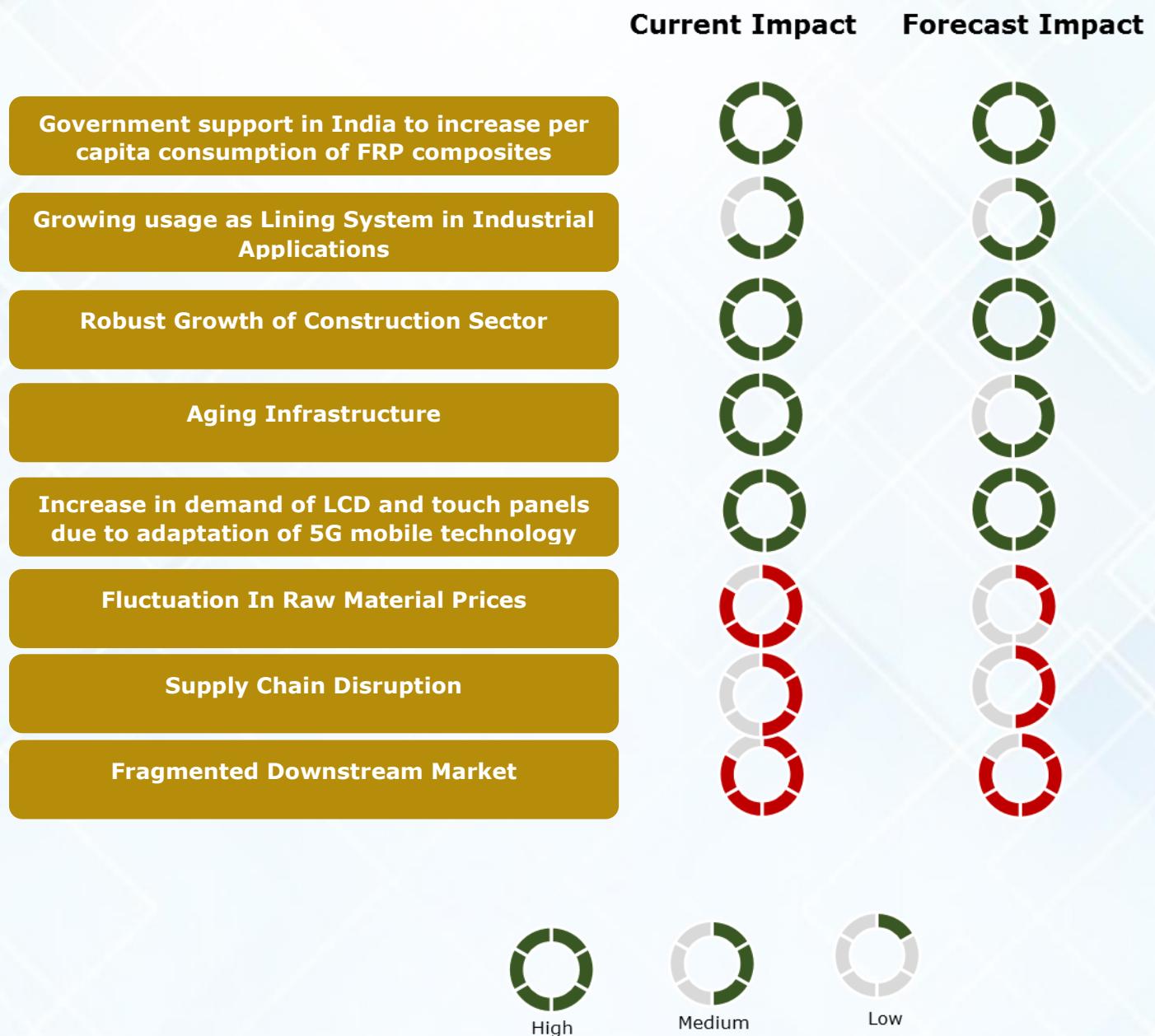
Figure 48: Middle East & Africa Vinyl Ester Resin Sales, By Company, By Volume (000' Tonnes), 2020



Others include Imports

Source: TechSci Research

3.3. MARKET DYNAMICS



Market Drivers

Government support in India to increase per capita consumption of FRP composites

Driven by strong demand from various end use industries such as wind energy, transportation, electrical and electronics, defence, aerospace, pipes and tanks, construction and marine, the composite industry, also known as fiber-reinforced plastics (FRP) industry, will also be supporting government's 'Make in India' initiative giving a big push to future market of vinyl ester resin. The per capita consumption of composites in China and the United States has been 2.8 kg and 11.4 kg, respectively in 2021. The per capita consumption in India stood at 0.36 kg in 2021, which is the lowest.

Growing usage as Lining System in Industrial Applications

Vinyl ester resin lining systems are used in several industrial applications like water treatment, chemical processing, and air pollution control and mineral processing as they provide unparalleled corrosion resistance to fiberglass reinforced plastic tanks, ducting, stacks & chimneys, scrubbers, pipes and other components. Therefore, vinyl ester resin liners fit best for the most challenging industrial environments due to their properties like high heat resistance, exceptional durability, and minimal maintenance requirements.

Robust Growth of Construction Sector

With rising urban population and public and private sector investments in construction projects, the overall construction market is witnessing rapid growth. The demand for vinyl ester resins in building & construction industry has been rising over the last few years owing to their varied Types including Bisphenol, Novolac and Brominated. Robust growth in construction sector in Japan coupled with the implementation of favourable government policies to support infrastructure development are the primary factors expected to influence the demand.

Aging Infrastructure

The aging infrastructure is driving opportunities for building materials including VFR based FRP tanks. Most of the infrastructure such as roads, water supply and sewerage systems constructed in developed nations are 30-40 years old. The government and local civic bodies incur huge maintenance cost hence there is an urgent need for repair of these systems.

Europe Percentage of Infrastructure that is minimum 50 years old, 2018, 2023 & 2033

	2018	2023	2033
Highway Bridges	Approx. 25%	Approx. 39%	Approx. 63%
Tunnels	Approx. 20%	Approx. 27%	Approx. 42%
River Management Facilities	Approx. 32%	Approx. 42%	Approx. 62%
Sewage Pipes	Approx. 4%	Approx. 8%	Approx. 21%

Source: Eurostat

Market Challenges

Fragmented market of composites industry in China and India

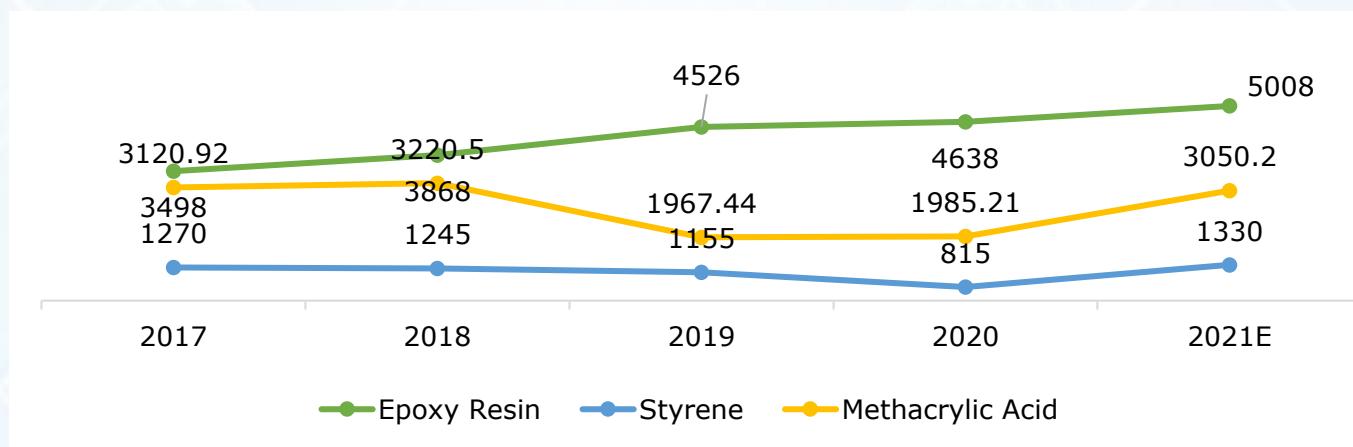
The fragmented composite industry in India and China consists of around 15000 stakeholders in the value chain including small, mid-sized and large players. Also, the lack of awareness among end-user industries is the major challenge for the growth of vinyl ester which also impacts the margin of the industry. Lack of regulatory framework, absence of a recycling policy and standardization of end-use products are some of the major challenges for the composites

industry. Global composites market is highly fragmented with more than 1000 mid and small regional players operating in the market.

High Volatility in Raw Material Prices

Styrene, epoxy resin, methacrylic acid, etc., are few of the raw materials majorly used in the production of construction sealants and bonding such as butyl rubber, acrylic urethane, silicone rubber sealant, etc. Over the years, raw materials used in sealants industry have observed price fluctuations globally. Diligently working on product selling prices to react to changes in raw material cost and simultaneously maintaining market share is a key challenge for construction sealants producers

India Styrene Monomer, Methacrylic Acid and Epoxy Resin Prices, 2017-2021E (USD per Ton)



Source: TechSci Research

3.4. MARKET TRENDS & DEVELOPMENTS

Capacity Expansion by Existing Players in APAC Region

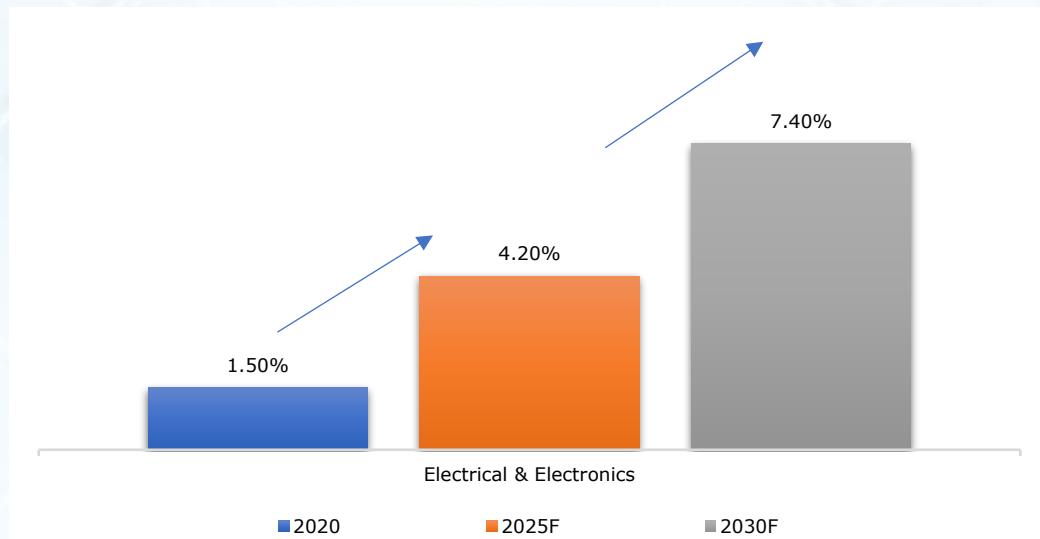
With growing demand for Vinyl Ester Resin in various sector such as wind energy, transportation, electrical and electronics, defence, aerospace, pipes and tanks, construction and marine, companies have started investing in expanding manufacturing facilities. Moreover, companies are increasingly focusing on developing nations like China and India, due to availability of cheap labor in these countries. For instance, Showa Denko Group completes expansion of lines to produce vinyl ester in Shanghai due to increasing demand of the product in electronic parts such

as Liquid Crystal Displays (LCDs) and touch panels on account of the progress in telecommunication technologies.

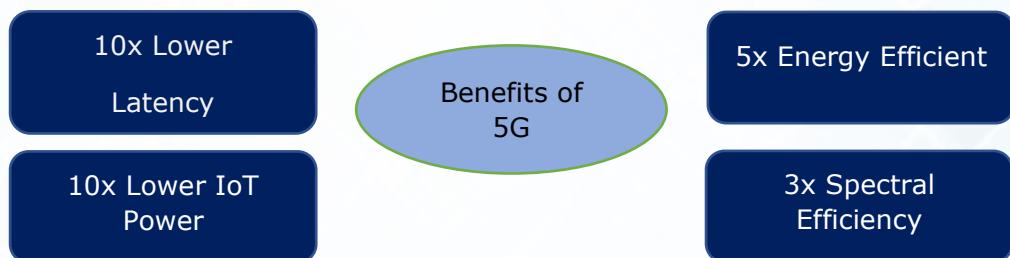
Emerging applications

The emerging application of vinyl ester resin is in electronics and telecommunication due to its use in the process to produce electronic parts including LCDs and touch panels, which has been rapidly increasing in APAC region mainly in China. Moreover, its application in pipes and tanks, marine industry, defence, transportation, etc. has been rapidly increasing due to its excellent corrosion resistance and chemical resistance properties. Vinyl Ester resins' usage in the making of pipes and tanks also adds to their increasing demand. Growing utilization of Vinyl Ester Resins in electronics and telecommunications is likely to increase its foothold in the market over coming years.

Electrical & Electronics Industry Market Share in Vinyl Ester Resin Applications, 2020, 2025F and 2030F



The future wave in the telecom industry is the 5G network, which covers less distance than the existing 4G network. In India, the Ministry of Telecommunications and The Telecom Regulatory Authority of India (TRAI) plans to implement 5G in the coming years. With this implementation, usage of VER for the telecom industry is expected to register strong growth in the coming years.



Mergers and Acquisitions

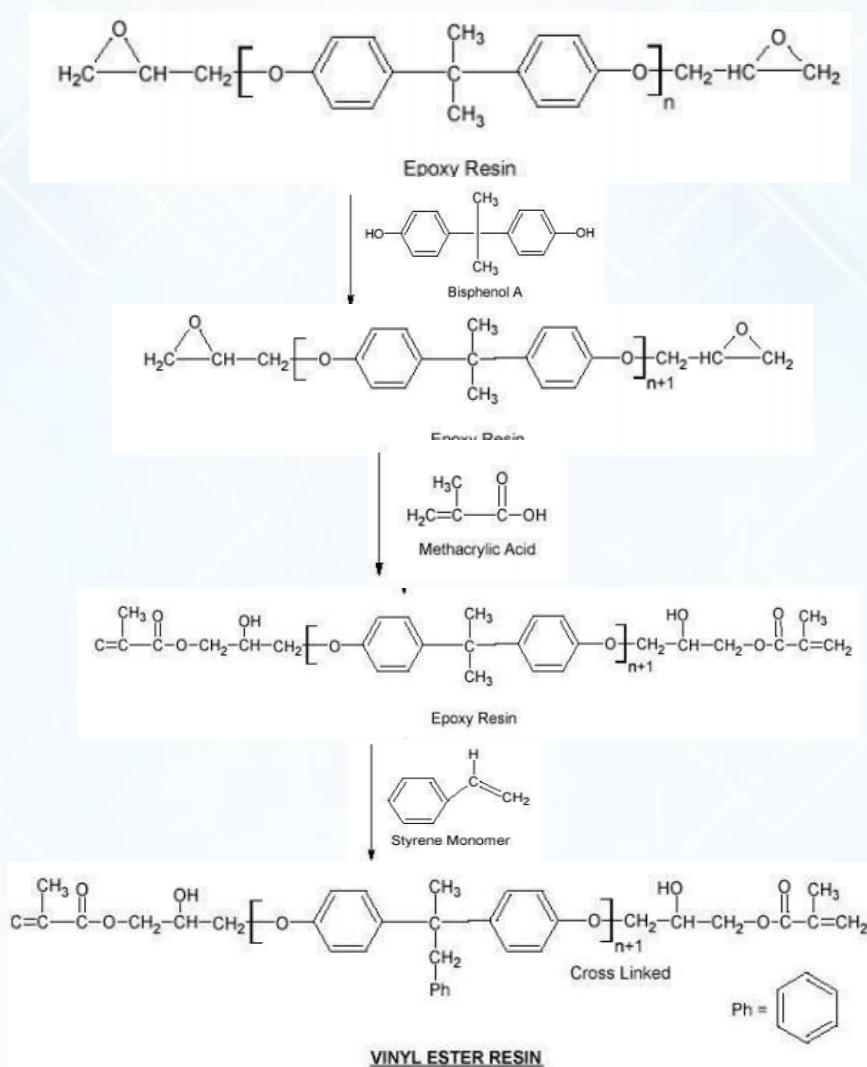
Merger & acquisition activities are becoming prevalent in the vinyl ester resin market globally. In 2019, INEOS Composites acquired Ashland Composites. Additionally, Polynt and Reichhold also had a merger in the same year to expand and increase their market share. Showa Denko, a prominent player in the vinyl ester resin market, is continuously expanding its capacity to cater to the increasing demand in China.

Mergers & Acquisitions in Vinyl Ester Resin Industry			
S.No.	Target Company	Acquirer / Merged Entity	Year
1	Mar-Bal Inc	Chagrin Falls, Ohio	2020
2	Ashland Global Holdings Inc.	INEOS Enterprise	2019
3	Aliancys & AOC Resin	CVC Capital Partners	2018
4	Polynt	Reichhold Group	2017
5	Kemrock Industries Ltd	Reliance Industries Ltd	2018

3.5 Technology Evaluation:

Vinyl Ester Resins are downstream products of Epoxy Resin. Most manufacturing companies have their in-house technologies and R&D facilities to make formulations. Key reactions are carried out with the help of a batch reactor and blender which can be outsourced. Conventionally, manufacturing process involves charging batch reactor with a feedstock and then blending it with an organic solvent such as styrene monomer. There is no technology licensor for the product. Indian manufacturing company Atul limited has vertically integrated Epoxy resin capacity and downstream integrated Vinyl Ester Resin capacity while other Indian players such as Innovative Resins, Satyen Polymers, Mechemco Resins among others have In-house batch reactor set up. However, they depend on domestic or international market for feedstocks Epoxy resin, Bisphenol-A, and other additives.

Reaction Involved



Manufacturing Process

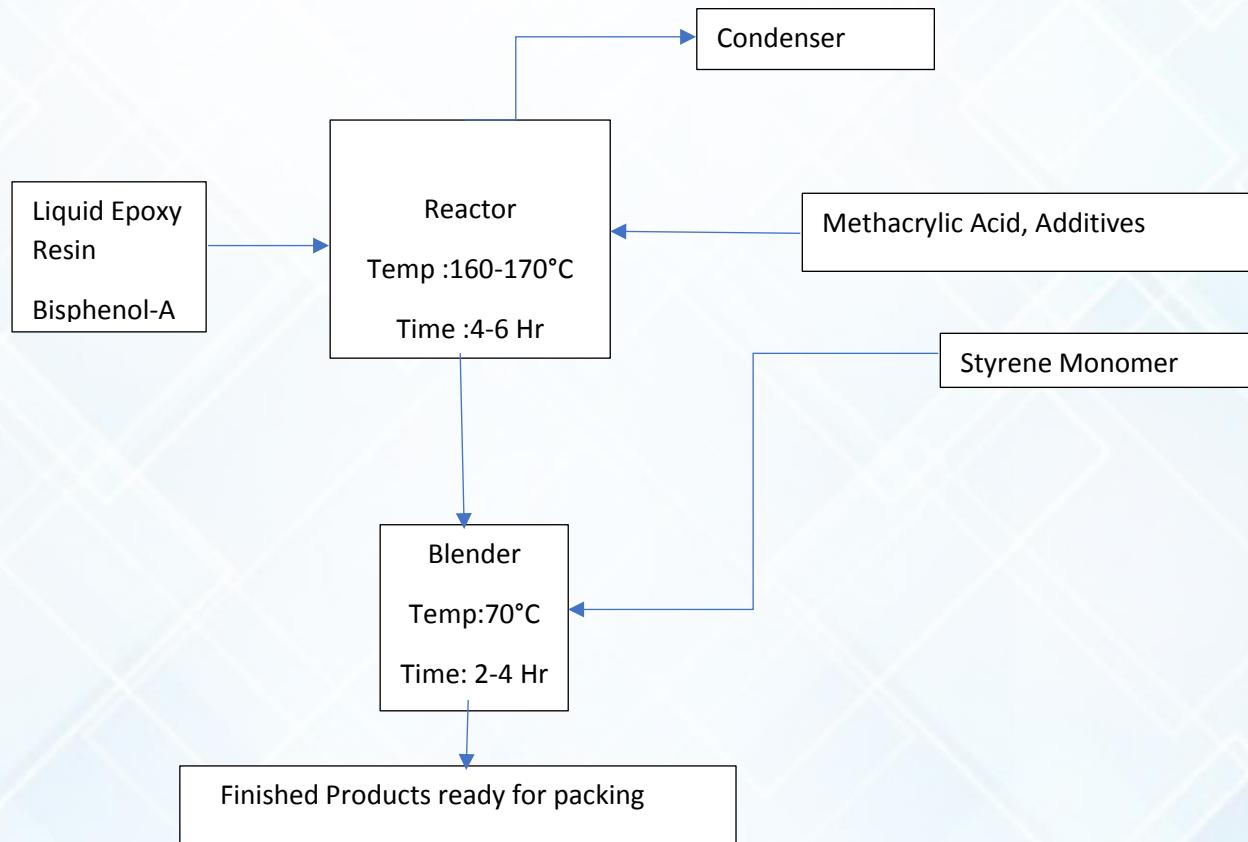
Vinyl Ester Resin (VER) has been manufactured in a batch reactor, traditionally. Initially, the reactor needs to be charged with a mixture of Epoxy resin, Bisphenol-A and should be heated for 4-5 hours to the temperature of 160-170°C. Then, decrease the reactor temperature to 100-120°C and add Methacrylic acid to advance the esterification process. Esterification takes place along the epoxy chain between carboxyl and epoxy group and likewise between carboxyl and hydroxyl group. As the temperature declines to 100° C, additives like Maleic Anhydride and Tri-Ethyl Amine needs to be added as a base catalyst and the mixture is heated for another 4-6 hours.

After that, Epoxy Resin needs to be withdrawn from the batch reactor and fed to the blender containing Styrene Monomer which is a volatile organic solvent. During polymerization, styrene reacts with vinyl esters to form cross linking at unsaturation points. This cross linking provides high polymerizability and improved resin processability. In addition to this, Styrene Monomer also acts as a diluent to reduce viscosity and improve curing degree leading to excellent mechanical and thermal properties of composite epoxy solution. Further, Blender temperature should be maintained around 70° C. Finally, Water is circulated around blender jacket to gradually cool and reduce the heat to room temperature. Generally, it takes 12-14 hours to process Vinyl Ester Resin. It's a very critical and temperature sensitive reaction and should be undertaken with utmost caution as a small error can gel the batch immediately.

As all the raw materials used will be consumed in the process itself, hence there will not be any generation of by-product, Effluent, Gaseous waste, solid waste.

Finally, the finished product is withdrawn from blender and packed in drums.

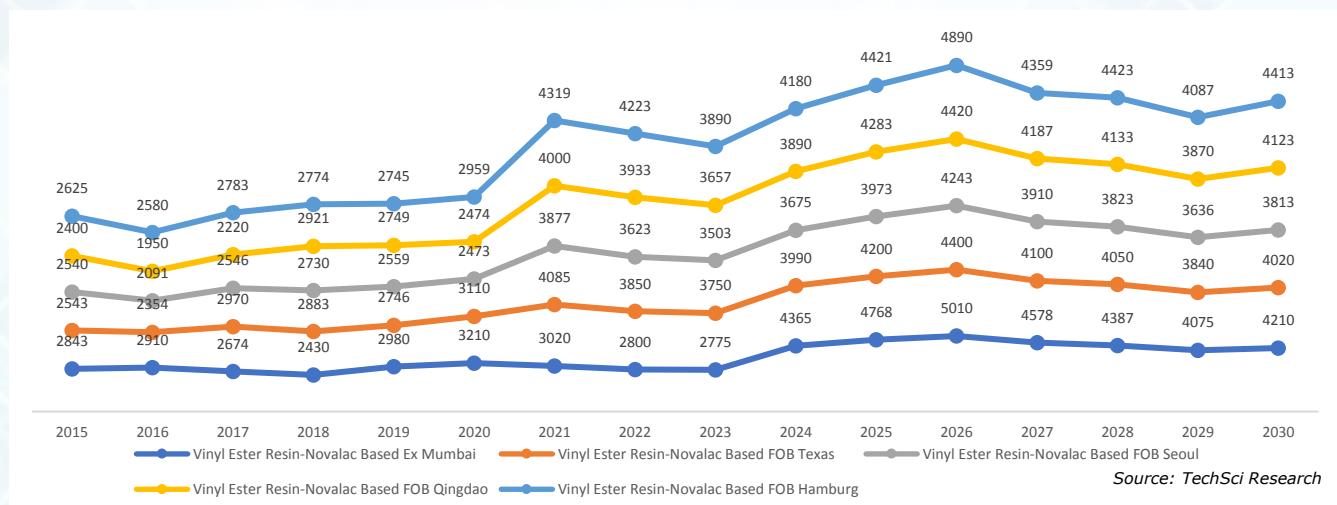
Process Flow Diagram



3.6. Pricing Analysis

Discussions on Vinyl Ester Resin remained firm since the beginning of 2021 following the pickup in the market activities as the economy significantly rebounded from COVID-19 repercussions. However, the increment has been marginal yet consistent due to constraint fluctuations in base Novolac costs. There has been little to no adverse impact of the second wave of Covid in India, as demand for the material remained consistent from packaging sector amidst favourable consumer sentiments. Thus, after showcasing a marginal dullness in May 2021, prices again revived in June 2021, following the resumption in market activities across the nation. Besides, soaring freight cost along several trade routes since the beginning of 2021 has also contributed to raise in values at times of prevalent demand pattern.

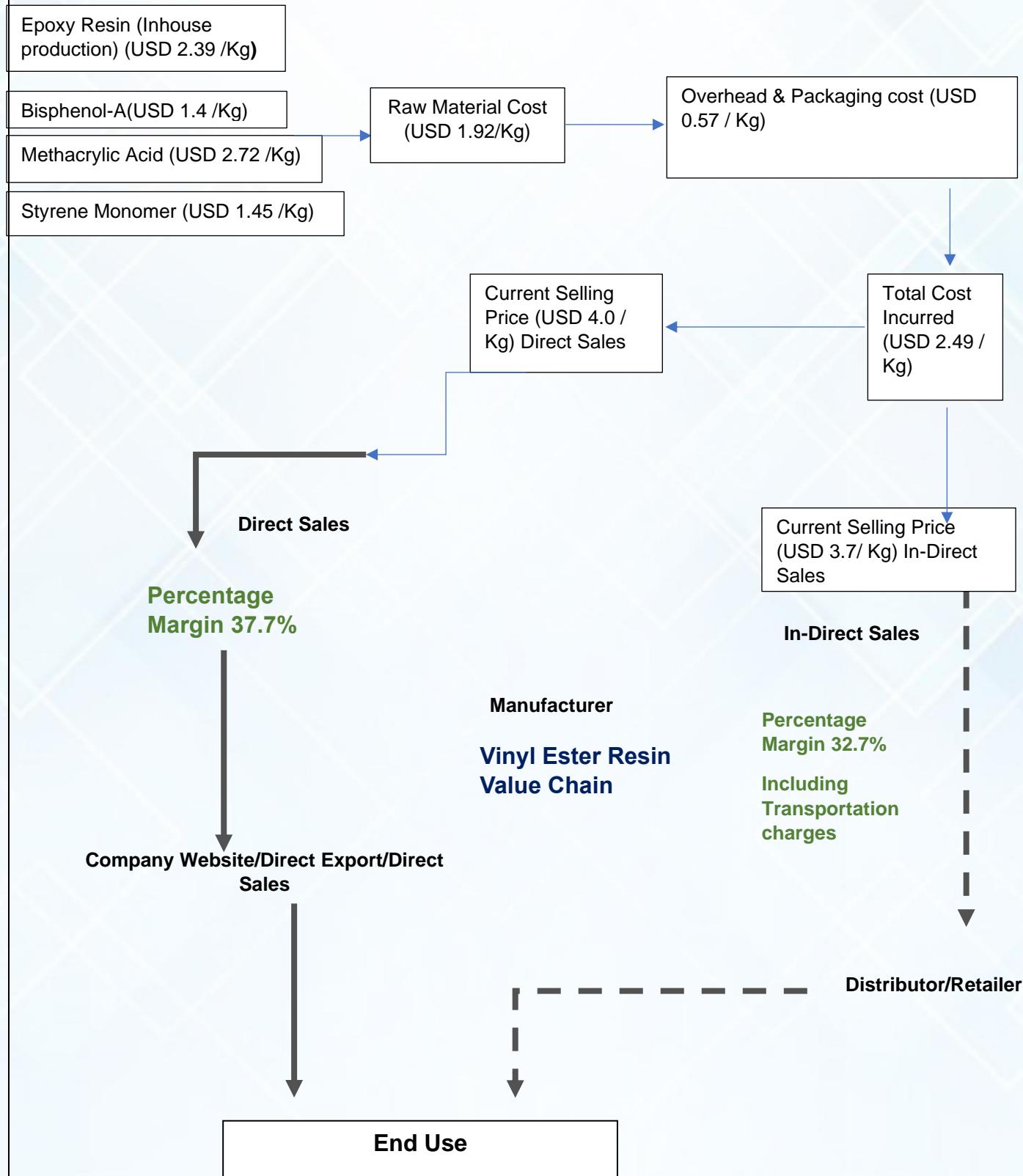
Global Vinyl Ester Resin Yearly Prices, 2015-2030 (USD/Tonne)



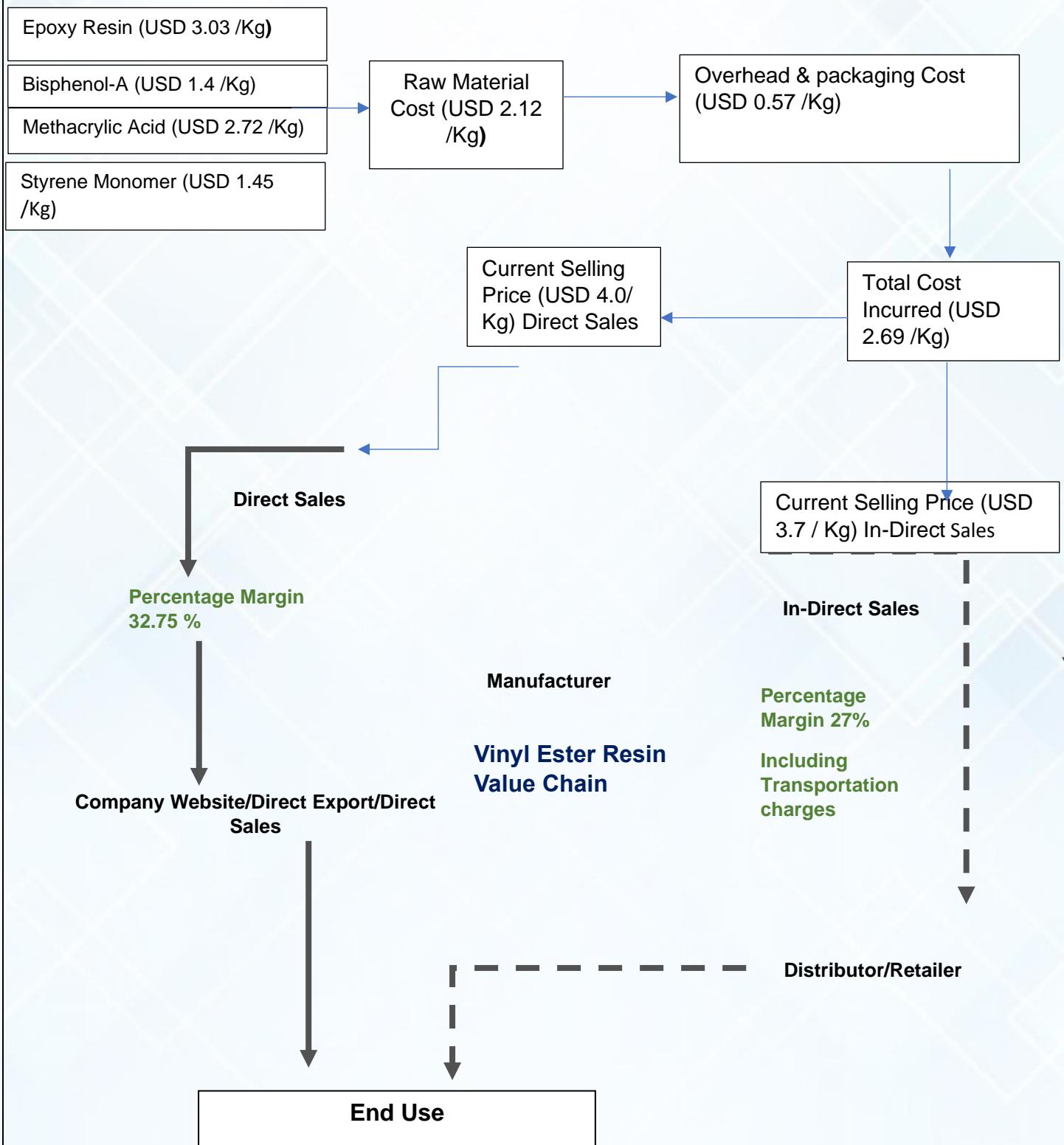
Sharp fall in values of upstream crude in 2016 hampered the performance of the overall chemical and petrochemical sector leading to a drop in prices of Vinyl Ester Resin along with various other products. Its market fundamentals revived significantly in 2017 following sharp rebound in market activities. However, in 2019 and 2020 prices remained in a stable to narrow range amidst the uncertainty prevailing from stable feedstock and muted demand pattern. In Q1 and Q2 2020, VER witnessed a marginal dive, due to ground-breaking fall in crude values and devastating hit on the global economy in the wake of the Covid outbreak.

3.7 Value Chain Analysis for Captive Vinyl Ester Resin Manufacturer

Value Flow Analysis for Captive Vinyl Ester Resin Manufacturer



Value Flow Analysis for Non-Captive Vinyl Ester Resin Manufacturer



3.8 Cost of Production

COST OF PRODUCTION				
A	VARIABLE COST	Norm of Consumption	Unit Rate	Amount
			USD / Tonne	USD
1	RAW MATERIALS			
I	Epoxy Resin (Merchant)	0.3	3030	909
II	BPA	0.14	1400	196
III	Methacrylic Acid	0.11	2720	299
IV	Styrene Monomer	0.45	1450	653
	Sub-Total (1)		8600	2057
2	Packing Materials			147
3	Catalyst & Chemicals			65
4	Utilities			55
	TOTAL VARIABLE COST	2324		
B	FIXED COST			
1	Repair & Maintenance			250
2	Salaries & Wages			
3	Research & Development			
4	Transportation & Clearance			
5	Corporate Overheads			
	TOTAL FIXED COST			250
C	VARIABLE + FIXED COST			2574
D	INTEREST ON WORKING CAPITAL			20
E	CASH MANUFACTURING COST			2594
F	DEPRECIATION			1.9
G	PRODUCTION COST	2596		

Source: TechSci Research

3.9. Customer Analysis

Product Description	Customer / Distributor Name	Destination Country	Supplier Name	Shipment Origin	Annual Off-take Quantity (Tonnes)	Price (<u>USD/Kg</u>)
Bisphenol-a Type Epoxy Vinyl Ester Resin	Reichhold India Private Limited	India	Reichhold Polymers Tianjin	China	2,634.48	3.78
Bisphenol-a Type Epoxy Vinyl Ester Resin	Carborundum Universal Limited	India	Swancor Ind M Sdn Bhd	Malaysia/Taiwan/China	588.17	2.23
Bisphenol-a Type Epoxy Vinyl Ester Resin	Orson Chemicals	India	Swancor Ind M Sdn Bhd	Malaysia/Taiwan	1,052.25	2.56
Bisphenol-a Type Epoxy Vinyl Ester Resin	Sunrise Industries India Ltd	India	Jinling Aoc Resins Co Ltd	China/Thailand	369.6	3.52
Bisphenol-a Type Epoxy Vinyl Ester Resin	Rex Resins	India	Eternal Materials Co Ltd	Taiwan	34.2	2.1
Bisphenol-a Type Epoxy Vinyl Ester Resin	Vibrant Specialties	India	Synthomer Trading Limited	France	40.5	2.21
Novolac Vinyl Ester Resin	Chemical Process Equipments Pvt Ltd	India	Ineos Composites	Spain	471.97	5.74
Bisphenol-a Type Epoxy Vinyl Ester Resin	Nagase India Private Limited	India	Showa Highpolymer Singapore Pte Ltd	Japan	243.81	3.01
Bisphenol-a Type Epoxy Vinyl Ester Resin	Dakle Industrial Plastics	India	Z To Order NA	Taiwan	32	2.31
Bisphenol-a Type Epoxy Vinyl Ester Resin	BASF India Limited	India	Basf Construction Chemicals Uae Llc	United Arab Emirates	24.27	11.26
Bisphenol-a Type Epoxy Vinyl Ester Resin	Apex Printing Sleeves India Private Limited	India	M S Aoc Llc	United States of America, Poland	28.03	7.09
Bisphenol-a Type Epoxy Vinyl Ester Resin	Devi Polymers Private Ltd	India	Eternal Materials Co Ltd	Taiwan	9.2	2.33
Bisphenol-a Type Epoxy Vinyl Ester Resin	Emerald Performance Chemical Private Limited	India	Eternal Materials Co Ltd	Taiwan	2	2.04

Novolac Vinyl Ester Resin	Mahindra Cie Automotive Limited	India	M S Swancor Highpolymer Co Ltd	Taiwan	3.1	2.78
Bisphenol-a Type Epoxy Vinyl Ester Resin	Epp Composites Pvt Ltd	India	Eternal Materials Co Ltd	Taiwan	48	3.18
Bisphenol-a Type Epoxy Vinyl Ester Resin	Hindustan Zinc Limited	India	China Nonferrous Metal Industrys Foreign Engineeri	China	5	7.11
Bisphenol-a Type Epoxy Vinyl Ester Resin	Jrd Polymer Pvt Ltd	India	Aliancys Ag	France	16.05	3.87
Bisphenol-a Type Epoxy Vinyl Ester Resin	Kalinga Inceptum Private Limited	India	Eternal Materials Co Ltd	Taiwan	2.06	2.94
Novolac Vinyl Ester Resin	Mahindra Cie Automotive Limited	India	M S Swancor Highpolymer Co Ltd	Taiwan	3.1	2.78
Bisphenol-a Type Epoxy Vinyl Ester Resin	Future Pipe Industries	Egypt	Eternal Materials Co Ltd	Taiwan	600	2.73
Bisphenol-a Type Epoxy Vinyl Ester Resin	Saudi Arabian AMIANTIT Company	Saudi Arabia	Sino Polymer	China	1,440.00	5.83
Bisphenol-a Type Epoxy Vinyl Ester Resin	B A F F Polymech Pvt Ltd	Sri Lanka	Scott Bader Middle East Ltd	United Arab Emirates	7.61	4.5
Bisphenol-a Type Epoxy Vinyl Ester Resin	Edgeng Pvt Ltd	Sri Lanka	Wee Tee Tong Chemicals Pte Ltd	Singapore	3	2.58
Bisphenol-a Type Epoxy Vinyl Ester Resin	Bin Tariq (Pvt) Limited	Pakistan	Changzhou Pro-tech Trade Co.,Ltd,	China	14.4	2.37
Bisphenol-a Type Epoxy Vinyl Ester Resin	Fiber Craft Inds.	Pakistan	Saudi Industrial Resins Limited	Saudi Arabia	12.3	3.2

Source: TechSci Research

3.8. Global Foreign Trade Analysis

Global Vinyl Ester Resin Trade Dynamics – Import, By Volume (000' Tonnes), By Value (USD Million) , 2015-2020

Country	2015		2016		2017		2018		2019		2020	
Import	Value	Volume										
United States	25.63	12.83	32.61	15.03	30.15	15.03	42.94	17.95	28.04	14.81	26.91	16.82
China	5.12	2.73	35.81	17.05	50.05	24.06	38.05	19.92	35.91	19.92	20.05	11.71
Brazil	6.42	3.15	13.55	6.1	12.88	6.7	15.03	7.25	14.91	7.30	12.91	6.95
India	5.16	2.44	8.12	4.05	11.21	5.91	6.22	3.05	8.94	4.15	9.15	6.70
Mexico	3.05	1.52	6.42	3.21	8.25	4.20	6.21	3.05	7.25	3.77	9.21	5.62
Turkey	2.15	1.05	4.15	2.82	6.43	3.25	5.62	2.85	6.21	3.05	5.10	3.92
South Africa	5.12	2.50	5.12	2.73	4.21	2.12	5.21	2.62	5.53	2.91	4.73	2.84
Russia	2.44	1.73	4.41	2.73	3.21	1.56	4.15	1.82	5.25	2.81	5.12	2.82
Indonesia	5.81	3.05	3.12	1.55	3.04	1.22	2.63	1.73	5.05	2.54	3.57	2.05
Vietnam	10.25	5.4	2.84	1.50	1.26	0.63	3.05	1.44	1.83	1.00	2.44	1.44
Others	109.66	89.57	109.68	65.33	70.75	52.99	91.44	52.99	125.89	59.12	151.36	45.10
Total	180.91	125.99	225.83	122.12	201.44	117.69	220.55	114.67	244.81	121.38	250.55	105.97

Others Argentina, Iran, Qatar etc.

Source: TechSci Research

Global Vinyl Ester Resin Trade Dynamics – Export By Volume (000' Tonnes), By Value (USD Million), 2015-2020

Country	2015		2016		2017		2018		2019		2020	
	Export	Value	Volume	Value								
South Korea	22.73	11.04	15.09	8.41	15.38	9.18	15.59	9.20	11.04	6.33	11.82	6.53
Germany	26.13	12.02	28.10	12.16	23.63	15.66	35.37	13.65	41.97	16.11	37.58	15.48
Spain	19.32	9.20	16.55	9.30	19.75	12.88	24.57	10.53	25.69	14.45	25.65	14.70
China	17.74	7.68	22.24	7.77	23.84	10.54	21.06	7.61	28.95	12.27	25.91	10.14
Japan	13.54	6.39	12.12	6.46	11.94	8.25	13.61	6.35	13.68	7.95	13.19	7.12
Netherlands	6.12	2.36	5.16	2.39	5.68	3.28	6.70	2.73	6.85	3.50	6.58	3.64
USA	4.42	2.16	3.52	2.18	4.14	2.84	5.84	2.62	5.61	3.37	5.00	3.25
Poland	6.73	3.00	5.20	3.03	5.92	4.06	6.57	2.77	5.43	2.87	4.92	2.71
Saudi Arabia	5.39	2.37	6.56	2.40	9.23	3.30	8.54	3.03	9.63	3.34	6.36	2.53
Taiwan	3.87	1.95	4.72	1.97	5.59	2.65	6.15	2.37	6.74	2.65	6.70	2.38
Others	117.15	67.82	121.74	66.06	111.80	45.05	90.85	53.81	71.07	48.54	69.80	37.49
Total	243.15	125.99	241.01	122.12	236.89	117.69	234.86	114.67	226.64	121.38	213.51	105.97

Others Finland, Turkey, Russia etc

Source: TechSci Research

3.9. Global Demand-Supply Gap

Demand Supply Scenario

Global Vinyl Ester Resin Demand Supply Analysis, By Volume, 2015-2030F (Thousands Tonnes)

		2015	2016	2017	2018	2019	2020	2021E	2025F	2030F
Global	Capacity	938	938	953	965	980	985	1020	1025	1030
	Production	733	750	775	790	812	759	808	866	929
	Import	125.99	122.12	117.69	114.67	121.38	105.97			
	Export	125.99	122.12	117.69	114.67	121.38	105.97			
	Total Demand	677.49	707.79	734.69	767.44	796.32	739.49	789.09	1026.25	1367.33
	Y-O-Y Growth (%)	-	4.47%	3.80%	4.46%	3.76%	-7.14%	6.71%	6.42%	5.58%
	Demand Supply Gap							19.23	-159.81	-438.76

Source: TechSci Research

Asia Pacific Vinyl Ester Resin Demand Supply Analysis, By Volume, 2015-2030F (Thousands Tonnes)

		2015	2016	2017	2018	2019	2020	2021E	2025F	2030F
Asia Pacific	Capacity	427	427	427	427	442	442	477	482	487
	Production	315	326	337	340	357	327	369	399	441
	Total Demand	283.31	301.03	317.07	332.53	348.58	322.29	349.49	484.81	688.20
	Y-O-Y Growth (%)	-	6.26%	5.33%	4.88%	4.83%	-7.54%	8.44%	8.06%	6.84%
	Demand Supply Gap	0.00	0.00	0.00	0.00	0.00	0.00	27.90	-32.22	-102.63

Europe Vinyl Ester Resin Demand Supply Analysis, By Volume, 2015-2030F (Thousands Tonnes)

		2015	2016	2017	2018	2019	2020	2021E	2025F	2030F
Europe	Capacity	208	208	208	208	208	213	213	213	213
	Production	169.60	172.07	172.40	172.50	174.49	169.95	176.39	181.09	189.61
	Total Demand	171.09	175.88	179.66	185.58	189.85	177.60	187.10	228.54	281.95
	Y-O-Y Growth (%)	-	2.80%	2.15%	3.30%	2.30%	-6.45%	5.35%	4.72%	3.86%
	Demand Supply Gap	0.00	0.00	0.00	0.00	0.00	0.00	-10.70	-47.45	-92.34

Source: TechSci Research

North America Vinyl Ester Resin Demand Supply Analysis, By Volume, 2015-2030F (Thousands Tonnes)

		2015	2016	2017	2018	2019	2020	2021E	2025F	2030F
North America	Capacity	200.00	200.00	215.00	225.00	225.00	225.00	225.00	225.00	225.00
	Production	169.77	170.43	182.88	192.65	194.34	181.28	179.12	197.09	200.24
	Total Demand	152.59	157.31	162.11	169.14	174.44	163.53	172.74	214.79	274.88
	Y-O-Y Growth (%)	-	3.10%	3.05%	4.34%	3.14%	-6.25%	5.63%	5.36%	4.82%
	Demand Supply Gap	0.00	0.00	0.00	0.00	0.00	0.00	6.38	-17.69	-74.65

Source: TechSci Research

South America Vinyl Ester Resin Demand Supply Analysis, By Volume, 2015-2030F (Thousand Tonnes)

		2015	2016	2017	2018	2019	2020	2021E	2025F	2030F
South America	Capacity	20	20	20	22	22	22	22	22	22
	Production	16	17	17	18	19	16	17	18	20
	Total Demand	19.61	20.46	20.90	21.67	22.46	20.28	20.94	24.97	30.62
	Y-O-Y Growth (%)	-	4.33%	2.15%	3.64%	3.68%	-9.71%	3.23%	4.32%	4.05%
	Demand Supply Gap	0.00	0.00	0.00	0.00	0.00	0.00	-3.49	-6.93	-10.83

Source: TechSci Research

Middle East & Africa Vinyl Ester Resin Demand Supply Analysis, By Volume, 2015-2030F (Thousand Tonnes)

		2015	2016	2017	2018	2019	2020	2021E	2025F	2030F
Middle East & Africa	Capacity	83	83	83	83	83	83	83	83	83
	Production	63	65	66	67	68	64	66	71	78
	Total Demand	50.89	53.10	54.95	58.53	60.98	55.79	58.83	73.14	91.68
	Y-O-Y Growth (%)	-	4.33%	3.49%	6.51%	4.20%	-8.51%	5.45%	5.05%	4.42%
	Demand Supply Gap	0.00	0.00	0.00	0.00	0.00	0.00	7.23	-1.99	-13.96

Source: TechSci Research

India Vinyl Ester Resin Demand Supply Analysis, By Volume, 2015-2030F (Thousands Tonnes)

		2015	2016	2017	2018	2019	2020	2021E	2025F	2030F
India	Capacity	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
	Production	3.7	3.8	3.9	4.0	4.1	3.9	3.6	4.1	4.4
	Import	5.4	6.1	6.7	7.3	7.9	6.7	0.00	0.00	0.00
	Export	0.4	0.5	0.6	0.6	0.6	0.4	0.00	0.00	0.00
	Total Demand	8.7	9.3	10.0	10.6	11.3	10.1	11.1	16.8	30.0
	Y-O-Y Growth (%)	-	6.90%	7.53%	6.0%	6.60%	-10.62%	9.90%	10.86%	11.21%
	Demand Supply Gap	0.00	0.00	0.00	0.00	0.00	0.00	-7.46	-12.76	-25.55

Source: TechSci Research

Global Vinyl Ester Resin Demand, By Volume, 2020-2030F (000' Tonnes)

Demand Scenario	2020	2021E	2022F	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Optimistic	739.49	807.80	885.74	969.34	1058.92	1153.73	1254.68	1362.92	1477.58	1600.04	1729.79
Realistic	739.49	789.09	845.26	903.66	964.31	1026.25	1090.08	1156.54	1224.57	1295.08	1367.33
Optimistic	739.49	766.69	798.03	828.98	859.50	888.67	917.01	945.14	972.10	998.62	1024.07

Source: TechSci Research

India Vinyl Ester Resin Demand, By Volume, 2020-2030F (000' Tonnes)

Demand Scenario	2020	2021E	2022F	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Pessimistic	10.11	10.77	11.58	12.55	13.58	14.65	16.05	17.77	19.45	21.08	22.81
Realistic	10.11	11.08	12.24	13.64	15.17	16.81	18.92	21.52	24.21	26.97	30.00
Optimistic	10.11	11.33	12.80	14.59	16.59	18.81	21.64	25.16	28.93	32.96	37.48

Source: TechSci Research

3.12 Suggested Capacities

Global Scenario: The current global capacity of Vinyl Ester Resin is 985 thousand tonnes. Top five producers account for 54 percent of the total capacity. Regional analysis indicates surplus in Northeast Asia, and deficit in Indian Sub-continent, Europe, South America, Middle East and South America, resulting in heavy trade within the region as well as international trade. Overall Europe, Middle East & Africa and South America will remain a deficit area throughout the study period.

Indian Scenario: Present capacity in the country is 4.84 thousand tonnes and production are totally project based. These companies produce all the major grades conforming with global standards. It is expected that, based on individual end-use sector growth, consumption of vinyl ester resin will register an overall growth of about 11.70 percent per annum average growth over the next ten years' period.

India is expected to remain a deficit area and likely to increase from present level of 7.16 thousand tonnes per annum to 24.74 thousand tonnes per annum by 2030.

Considering demand – supply situation and export market, enough scope exists in the country for a 30 thousand tonnes per annum vinyl ester resin unit by 2023. Moreover, there is latent demand of the product due to anticipated growth in telecom, chemicals & petrochemicals, and renewable sector.

Recommendations

- RIL may consider setting-up a 30 thousand tonnes vinyl ester resin unit by the year 2030 in two phases (1st Phase 2023 and 2nd Phase 2027) as enough scope exists from demand – supply point of view. However, before taking up this decision, RIL should also consider the project from economic viability point of view.

- Considering capacity utilization of 60 percent in first year and 90 percent in second year onwards, entire quantity is likely to be absorbed within the country itself by 2030.
- Although as per demand – supply position, substantial gap in international markets is expected, exploring export is also advisable from realization angle.
- RIL should also have 100 percent captive epoxy resin, methacrylic acid and styrene monomer unit for better margin and assured supply of critical raw materials.

Name of the Product (Tonnes)	2023	2027	Total
Unsaturated Polyester Resin	25,000	25,000	50,000
Vinyl Ester Resin	15,000	15,000	30,000

Source: TechSci Research

4.3.5 Major Equipment List (List of major equipment in terms of value & importance)

S No	Equipment	Tag No
1	Hopper	H-101 &102
2	Crusher	T-101
3	Condenser	S-101
4	Vaccum Pump	VP-101
5	Batch Reactor	R-101
6	Epoxy Storage Tank	V-101
7	Epoxy Transfer Pump	P-101
8	Styrene Storage Tank	V-102
9	Styrene Transfer pump	P-102
10	Methyl Methacrylic storage tank	V-103
11	Methyl Methacrylic Transfer Pump	P-103
12	Jacketed Blender	B-101
13	Packaging Equipment	PA-101

Source: TechSci Research

4.3.8 Raw Material Required and Key Suppliers in India Market

S. No	Raw Material	Supplier 1	Supplier 2	Supplier 3	Supplier 4	Supplier 5
1.	Epoxy Resin (LER / SER)	Grasim Industries Ltd	Atul Ltd.	Kukdo Chemical Co. Ltd.	Huntsman Corporation	Hexion Inc.
2.	Bisphenol-A	Atul Ltd.	Dow Chemical	LG Chem	Mitsubishi Chemical	Mitsui Chemicals
3.	Methacrylic Acid	Evonik Industries	Dow Chemicals	Formosa Plastics	Kusumoto Chemicals Ltd	Celanese
4.	Styrene Monomer	SABIC	INEOS Group Ltd	Hanwha Group	Royal Dutch Shell plc	Chevron Phillips Chemical
5.	Tri-Ethyl Amine	Balaji Amines Ltd	Alkyl Amine Ltd	BASF SE	Eastman Corporation	Dow Chemicals

Source: TechSci Research