Executive Summary
Pre-Feasibility Report
PVC & Phenol: India

June 24, 2022

Prepared For

ओपीएएल
OPaL

Prepared By

TechSci Research
from NOW to NEXT

MARKET INTELLIGENCE . CONSULTING

Contents

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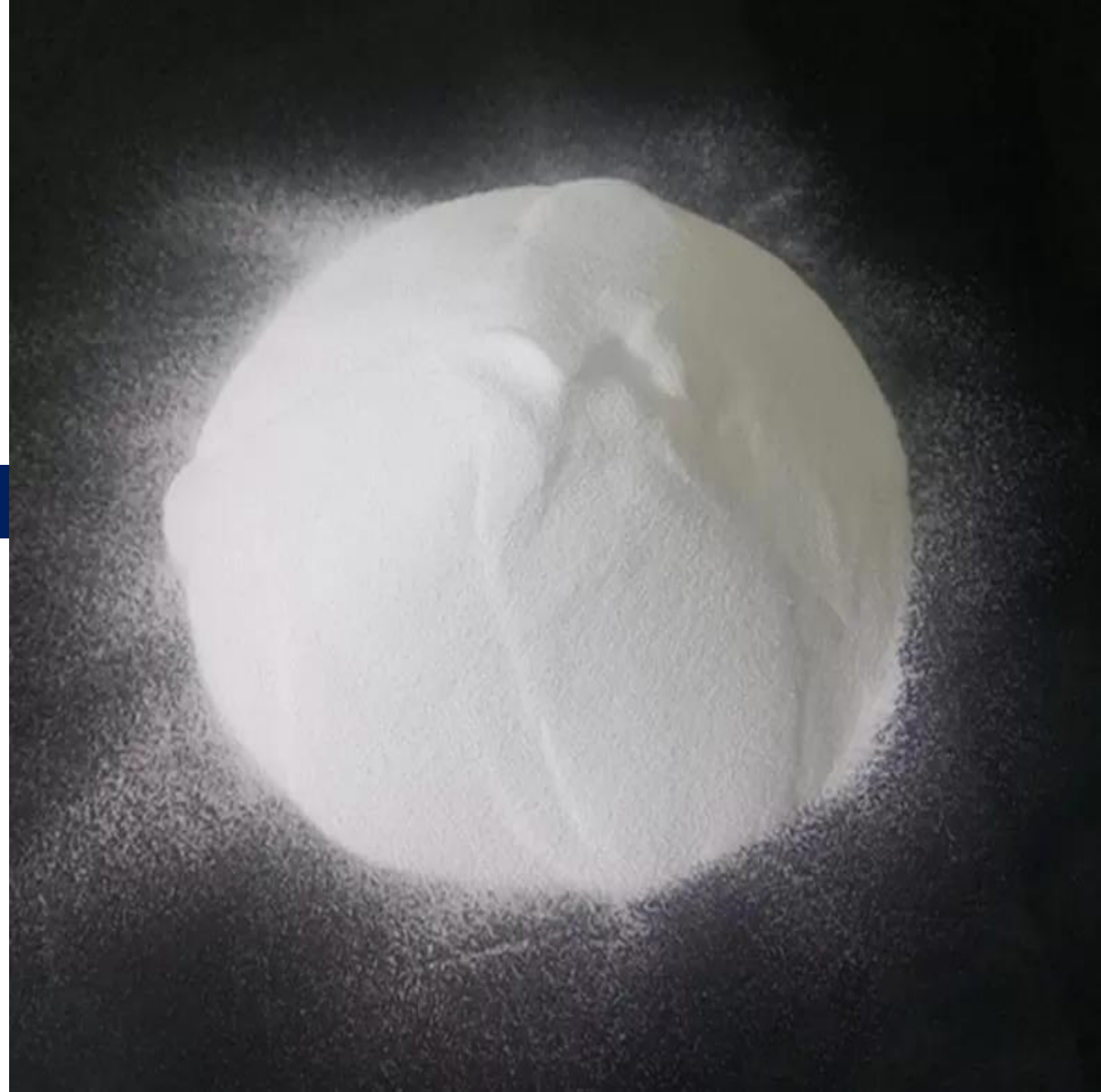
PVC



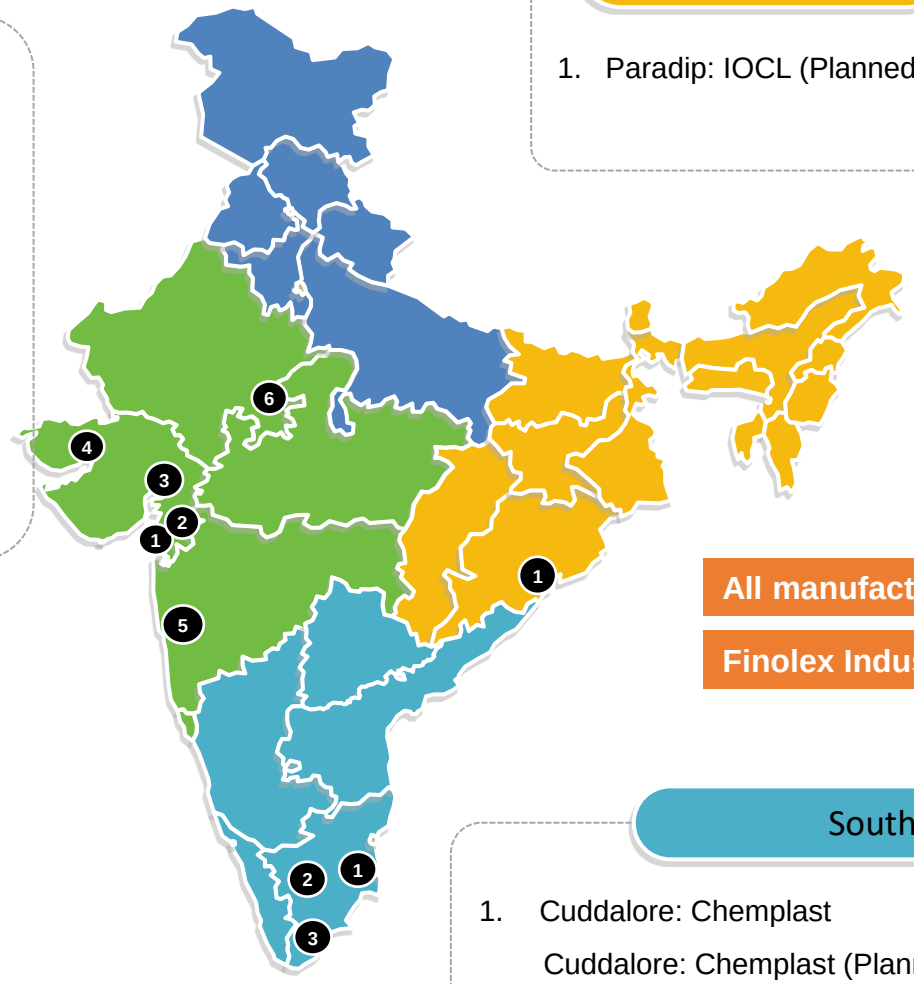
India: Manufacturing Landscape

West

1. Hazira: RIL
2. Vadodara: RIL
3. Dahej: RIL
   Dahej: RIL (Planned)
   Dahej: OPaL (Upcoming)
4. Mundra: Adani (Planned)
5. Ratnagiri: Finolex
6. Kota: DCM Shriram

East

1. Paradip: IOCL (Planned)



South

1. Cuddalore: Chemplast
   Cuddalore: Chemplast (Planned)
2. Mettur, Chemplast
3. Tuticorin, DCW Ltd.

India Polyvinyl Chloride (PVC) Capacity, By Company (000' Tonnes)

Company	Technology Provider	Capacity, FY2021
Reliance Industries Limited	BF Goodrich, USA (now known as Oxy Vinyl)	755
Finolex Industries Limited	Uhde, Germany	272
Chemplast Sanmar Limited	BF Goodrich, USA (now known as Oxy Vinyl)	366
DCW Limited	Atochem, France	90
DCM Shriram Limited	Kureha technology	70

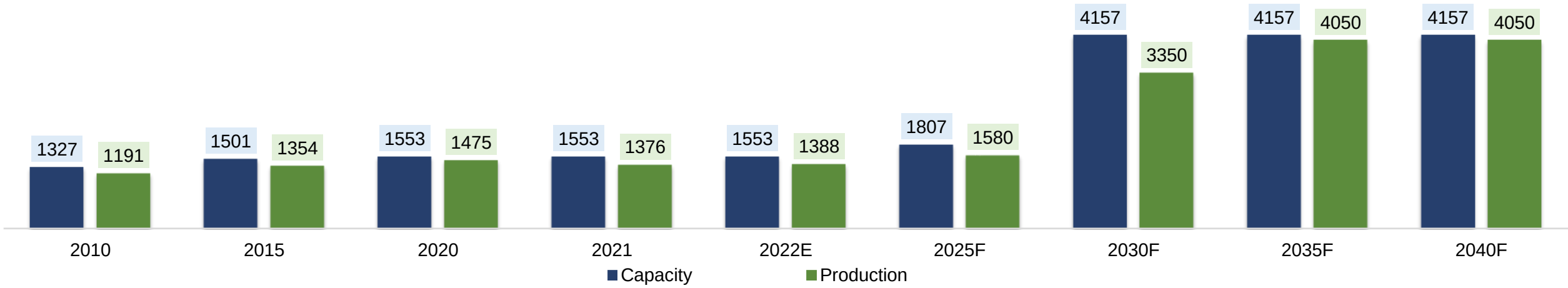
All manufacturers offer suspension grade.

Finolex Industries Limited & Chemplast Sanmar Limited also offer emulsion grade.

Source: TechSci Research

India: Capacity, Production

India Polyvinyl Chloride (PVC) Capacity and Production, By Volume (000' Tonnes), 2010 - 2040F



Upcoming PVC Plant details

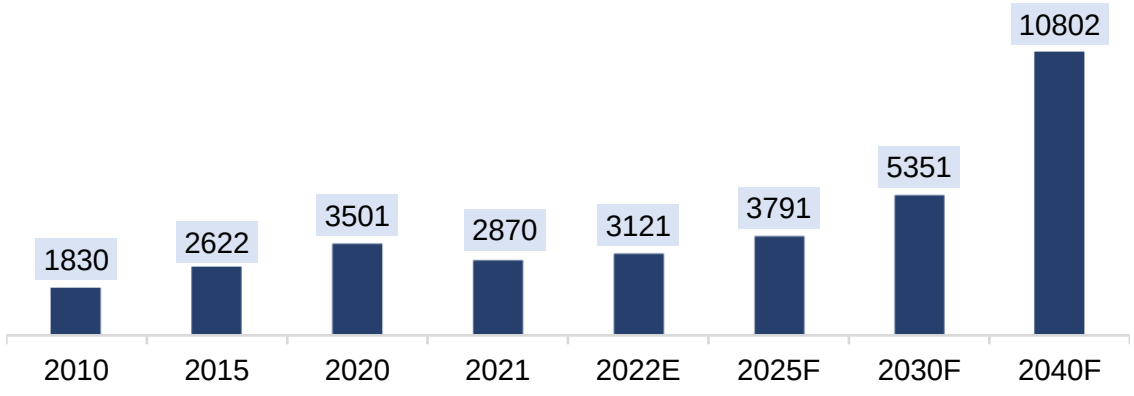
Upcoming Greenfield / Brownfield Projects will intensify the competition.

Company Name	Expected Capacity	Type of Process	Status
Indian Oil Corporation Limited	500KTPA	EDC / VCM to PVC	Availability of chlorine is a major challenge (Location Disadvantage)
Adani Enterprises Limited	1000KTPA	Coal to PVC	Submitted proposal for environmental clearance in April 2021.
Chemplast Sanmar Limited	236 KTPA (Brownfield Expansion) for Suspension Grade PVC	VCM to PVC	Received the environmental clearance and the project is in initial phase.
Reliance Industries Limited	1000 KTPA of Brownfield Expansion to produce S-PVC, Emulsion grade and C-PVC	Ethylene to PVC	Received the environmental clearance and. the project is in initial phase, expected to be commissioned by FY 2026.
ONGC Petro additions Limited	350 KTPA Greenfield Expansion	Ethylene to PVC	The project is in Initial stage and is expected to be commissioned by FY 2027.

Source: TechSci Research

India: Demand

India Polyvinyl Chloride (PVC) Demand, By Volume (000' Tonnes), 2010-2040F



CAGR 2010-2021	CAGR 2022E-2030F	CAGR 2031F-2040F
4.18%	6.97%	7.27%

India Polyvinyl Chloride Demand Supply Gap, 2010-2040F (000' Tonnes)

Parameters	2010	2015	2021	2022E	2025F	2030F	2040F
Capacity	1327	1501	1553	1553	1807	4157	4157
Production	1191	1354	1376	1388	1580	4050	4050
Import	659	1293	1595	1786	-	-	-
Export	0	2	75	27	-	-	-
Inventory	20	23	25	26	-	-	-
Demand	1830	2622	2870	3121	3791	5351	10802
Demand (Y-O-Y Growth Rate, %)	-	15.63%	-18.01%	8.74%	6.85%	7.31%	7.00%
Demand - Supply Gap	-	-		(1733)	(2211)	(1301)	(6752)

Demand-Supply Gap arguments the need for new player, even post-realization of ongoing/upcoming Greenfield/Brownfield Projects

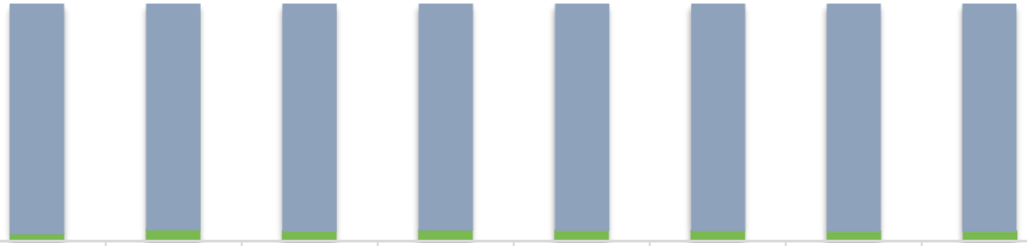
- Growing construction and agriculture sector is pushing the demand of PVC in India.
- Government's focus on Infrastructure development and low per capita consumption @ 2.24 kg, to drive future growth of the product.
- India will become world's third largest construction market by 2030, adding 12.7 million homes a year to become a USD1 trillion market
- uPVC Windows market is growing at a CAGR of 10% because of growing acceptance by Indian Builders and Architects boosting. There is effort to introduce IS standard
- Better market capitalization and lucrative demand of PVC in pipes and fittings.
- AatmaNirbhar Bharat" and "Make in India" policies are pushing domestic manufacturer to produce green field capacity to promote domestic manufacturing in the country.

Source: TechSci Research

India: Demand—Grade, End-Use,Type

India Polyvinyl Chloride (PVC) Demand, By Type, By Volume, 2010–2040F (000' Tonnes)

Suspension Grade is the most prominent type



	2010	2015	2020	2021	2022E	2025F	2030F	2040F
Suspension Polymerization	96.85%	95.09%	95.66%	95.30%	95.36%	95.49%	95.80%	95.75%
Emulsion Polymerization	3.15%	4.91%	4.34%	4.70%	4.64%	4.51%	4.20%	4.25%
Total	**1,830**	**2,622**	**3,501**	**2,870**	**3,121**	**3,791**	**5,351**	**10,802**

Suspension Grade PVC

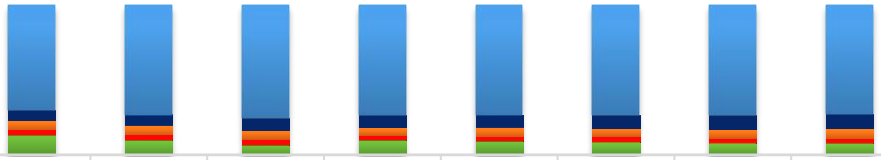
Used in manufacturing pipes and conduits.

Emulsion Grade PVC

Used for paste resin, battery separator plate, and copolymer resin.

India Polyvinyl Chloride (PVC) Demand, By End Use, By Volume (000' Tonnes), 2010–2040F

Pipes & Fittings is the most prominent end-use

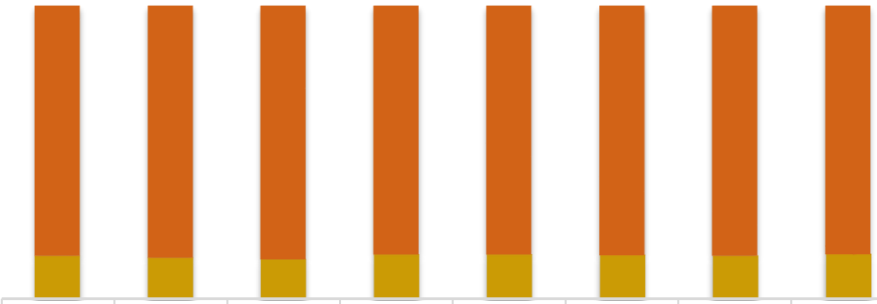


	2010	2015	2020	2021	2022E	2025F	2030F	2040F
Pipes & Fittings	70.12%	73.18%	75.23%	73.39%	73.44%	73.60%	73.92%	73.00%
Wires & Cables	6.46%	6.75%	8.10%	7.95%	8.05%	8.22%	8.54%	9.14%
Calendering (Films & Sheets)	6.06%	6.25%	6.07%	5.58%	5.63%	5.73%	5.94%	6.22%
Profiles	3.23%	3.34%	2.98%	2.80%	2.83%	2.93%	3.06%	3.30%
Footwear	0.52%	0.57%	0.62%	0.60%	0.65%	0.80%	0.74%	0.51%
Others	13.61%	9.91%	7.00%	9.68%	9.40%	8.72%	7.80%	7.83%
Total	**1,830**	**2,622**	**3,501**	**2,870**	**3,121**	**3,791**	**5,351**	**10,802**

Others include Medical & Healthcare, Vinyl Flooring, etc.

India PVC Demand by Rigid & Flexible Type

Rigid PVC is the most prominent type



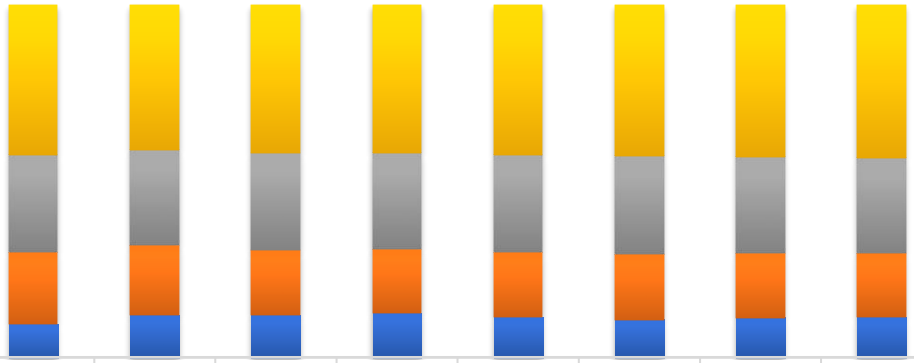
	2010	2015	2020	2021	2022E	2025F	2030F	2040F
Rigid PVC	85.12%	85.79%	86.37%	84.67%	84.70%	84.85%	85.15%	84.59%
Flexible PVC	14.88%	14.21%	13.63%	15.33%	15.30%	15.15%	14.85%	15.41%
Total	**1,830**	**2,622**	**3,501**	**2,870**	**3,121**	**3,791**	**5,351**	**10,802**

Source: TechSci Research

India: Demand—Region

India PVC Demand By Region, 2015-2040F

West India is the largest region



	2010	2015	2020	2021	2022E	2025F	2030F	2040F
West	42.56%	41.20%	42.23%	42.09%	42.59%	43.05%	43.25%	43.44%
South	27.56%	27.06%	27.37%	27.11%	27.47%	27.64%	27.30%	27.05%
North	20.34%	19.72%	18.39%	18.24%	18.56%	18.65%	18.22%	18.22%
East	9.54%	12.02%	12.01%	12.56%	11.38%	10.66%	11.23%	11.29%
Total	**1,830**	**2,622**	**3,501**	**2,870**	**3,121**	**3,791**	**5,351**	**10,802**

West India+South India : ~69% of the total demand

End-Use Sectors: infrastructure, agriculture, automotive, apparel, etc.

West

1. Hazira: RIL
2. Vadodara: RIL
3. Dahej: RIL
   Dahej: RIL (Planned)
   Dahej: OPaL (Upcoming)
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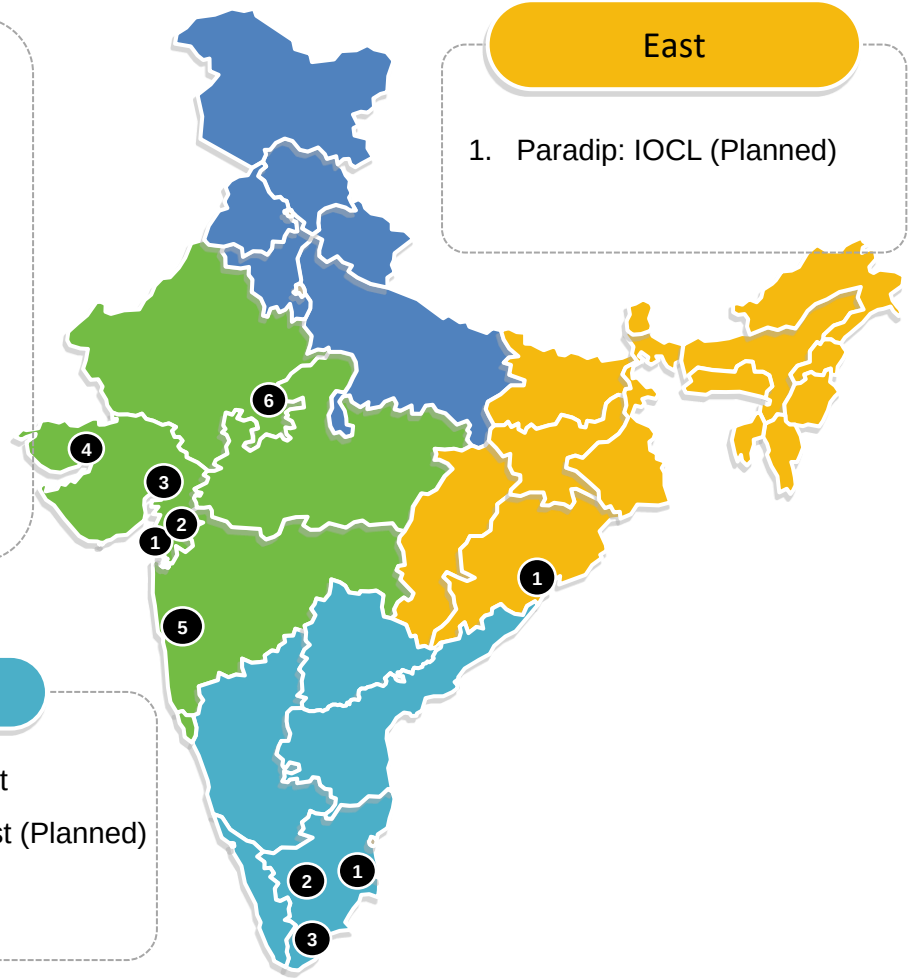
1. Paradip: IOCL (Planned)



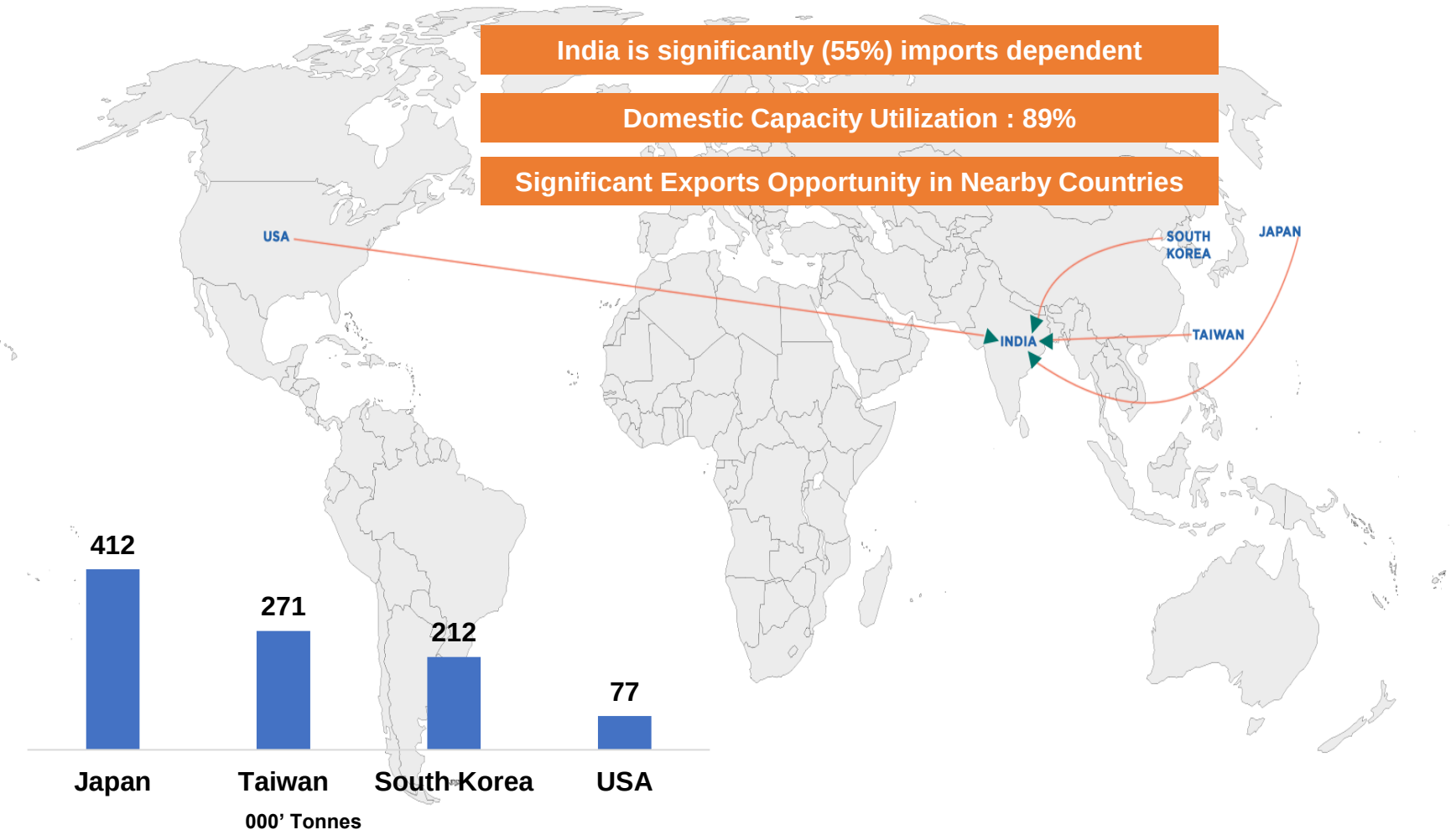
South

1. Cuddalore: Chemplast
   Cuddalore: Chemplast (Planned)
2. Mettur, Chemplast
3. Tuticorin, DCW Ltd.

Source: TechSci Research

India: Imports, Exports (Opportunity)

India Trade Imports PVC:2021



Note: - The Import data is calculated for 2020 (calendar year from January 2020 to December 2020), India Import data vary as Import Export were taken from DGFT for Financial Year where FY 2021 means (April 2020 to March 2021).

India is the largest importer of PVC with 1.6 million tonnes of imports in 2020.

Anti-dumping duties imposed on imports from China PR and USA withdrawn in Feb 2022

18% GST on PVC trade within the country

10% custom duty imposed on Import

PVC HS Code: 390410

Suspension Grade PVC HS Code: 39041020

Emulsion Grade PVC HS Code: 39041010

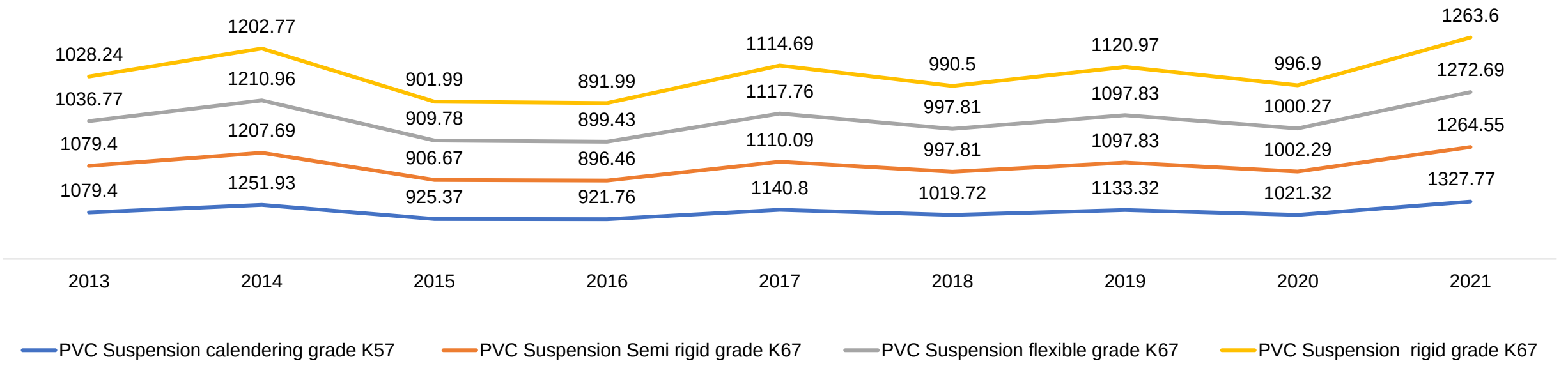
Countries	2020		Net Export Potential
	Import	Export	
Bangladesh	290.10	0	290.10
Malaysia	169.66	47.62	122.04
Myanmar	59.27	0	59.27
Sri Lanka	45.9	0	45.9
Singapore	36.87	2.35	34.52
Nepal	6.99	0	6.99
Total Export Potential			558.82

Source: Department of Commerce, Ministry of Commerce and Industry, Government of India

India: Pricing (Average) Trend

India PVC Suspension Ex- Mumbai Yearly Prices (FY 2013- FY 2021), USD/MT

Upward price trend is observed from 2020 Onwards



PVC price is primarily dependent on the fluctuating price of Ethylene/EDC/VCM

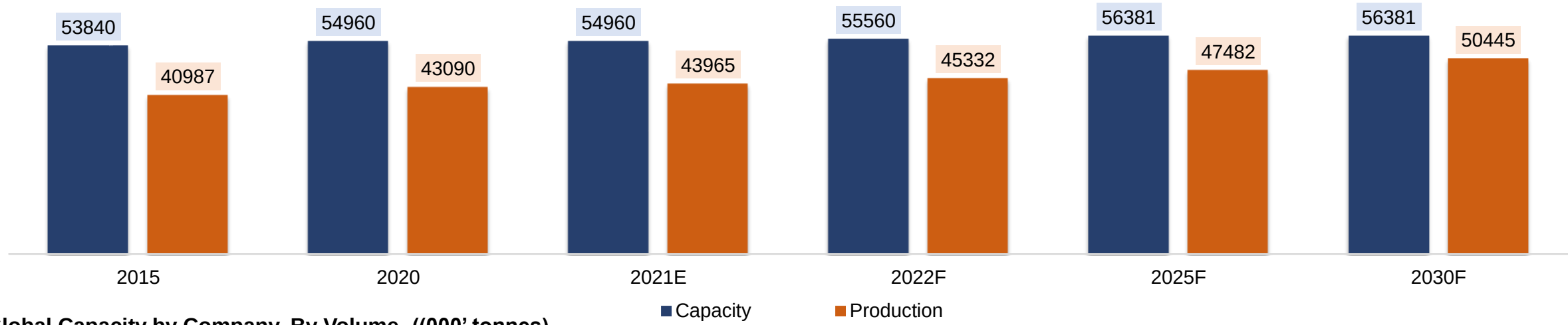
Factors impacting prices of PVC in India

- Increase in demand from construction sector.
- Import shortage and persistent hike in shipping charges across several trade routes along southeast Asia.
- Persistent hike in shipping charges across several trade routes along Southeast Asia
- Rise in demand from the agriculture sector in forthcoming crop season.
- Revision in domestic price of PVC across the country, can impact downstream users negatively, as it may squeeze their margin.

Source: TechSci Research

Global: Capacity, Production

Global Polyvinyl Chloride (PVC) Capacity and Production, By Volume (000' Tonnes), 2015 - 2030F



Global Capacity by Company, By Volume- ((000' tonnes)

Location	Companies	2015	2020	2021E	2022F	2025F	2030F
USA	Shin-Etsu, Formosa Plastics, Westlake, Occidental Petroleum, OxyVinyls, Georgia Gulf Corp	9837	10157	10157	10157	10678	10678
China	Xinjiang Tianye Chemical, Xinjiang Huatai Heavy Chemical, Sinopec Qilu Petrochemical, Yibin Haifing Herui, Hanwha Chemical, Tianjin Dagu Chemical	3560	3560	3560	3560	3560	3560
Germany	INOVYN, Vinnolit, VYNOVA	1450	1450	1450	1450	1450	1450
France	INOVYN, Kem One, VYNOVA	1445	1445	1445	1445	1445	1445
South Korea	LG Chem, Hanwha Chemical	1380	1380	1380	1380	1380	1380
	Others	36168	36968	36968	37568	37878	37878
	Total	53840	54960	54960	55560	56391	56391

India contributes ~3% of the global PVC capacity with 1,553 thousand tonnes of capacity in FY 2020

Asia Pacific is the largest demand generating region and holds around 40% of global capacity

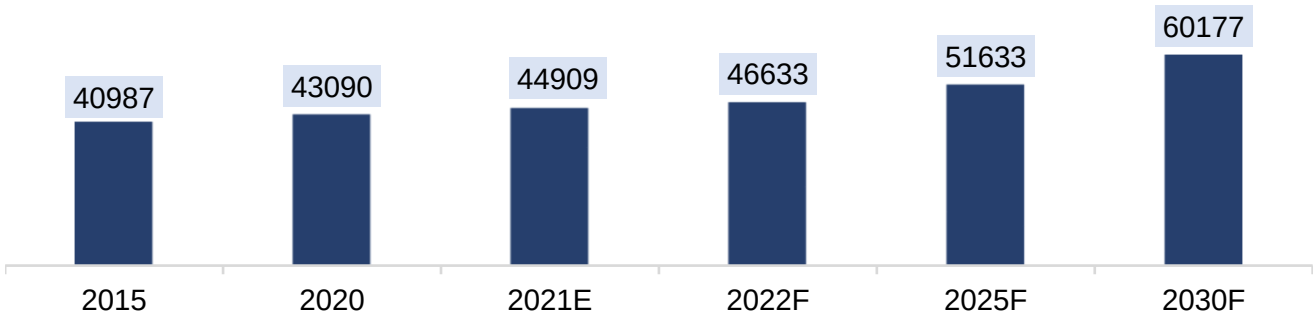
Shintech, Formosa Plastics, INOVYN, Occidental Petroleum, Westlake are top 5 PVC manufacturing companies globally (22% Capacity)

Rising demand for PVC in construction sector is anticipated to push the global demand for PVC

Source: TechSci Research

Global: Demand

Global Polyvinyl Chloride (PVC) Demand, By Volume (000' Tonnes), 2015-2030F



CAGR 2015-2020	CAGR 2021E-2030F
1.01%	3.31%

Global Polyvinyl Chloride Demand Supply Gap 2010-2040F (000' Tonnes)

Parameters	2010	2015	2020	2021E	2025F	2030F	2040F
Capacity	46604	53,840	54,960	54,960	56,381	56,381	56,381
Production	33840	40,987	43,090	43,965	47,482	48,358	50,445
Demand	33840	40,987	43,090	44909	51,633	60,177	80,097
Y-O-Y Growth Rate, %	-	-	-5.93%	4.22%	3.21%	3.05%	2.71%
Demand-Supply Gap	-	-	-	-943	-4,150	-9,732	-29,652

Global Polyvinyl Chloride (PVC) Demand, By End Use, By Volume (000' Tonnes), 2015–2030F

	2015	2020	2021E	2022F	2025F	2030F
Pipe and Fittings	42.31%	43.60%	43.86%	44.13%	44.93%	46.30%
Films and Sheets	18.75%	17.89%	17.73%	17.56%	17.08%	16.30%
Profiles and Tubes	15.20%	15.57%	15.65%	15.73%	15.96%	16.35%
Wires and Cables	7.45%	7.67%	7.71%	7.76%	7.89%	8.12%
Bottles	0.32%	0.54%	0.60%	0.67%	0.91%	1.54%
Others	15.97%	14.72%	14.45%	14.16%	13.23%	11.39%
Total	**40,987**	**43,090**	**44,908**	**46,635**	**51,632**	**60,177**

India contributes ~8% of the PVC global demand at 3,501 thousand (FY2020)

India contributes to ~14% of the Global PVC pipes & fittings market demand (FY2020)

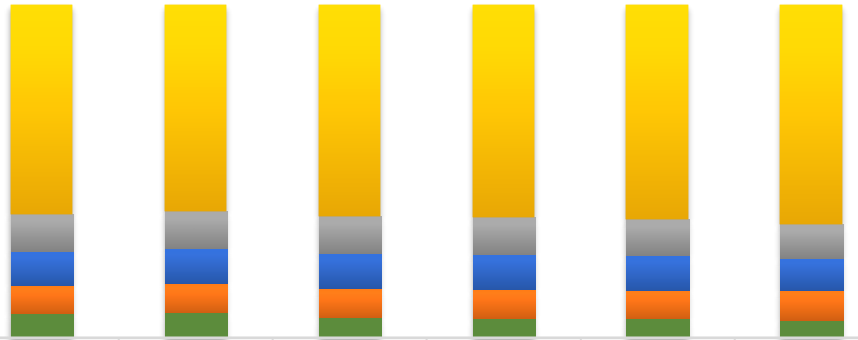
Vinnolit K GmbH / Krupp Uhde , Solvay Technology Solutions, Chisso, INEOS Technologies, The Geon Co., Vestolit GmbH / Hulls AG, and Hanwha are key technology providers for PVC for both grades (suspension and emulsion)

Source: TechSci Research

Global: Demand

Region	Factors Impacting Demand
Asia-Pacific	• Growing construction, healthcare, and packaging sector • Initiatives and construction projects such as China Belt and Road Initiative, construction of new airports, and roads, “Housing for All’, “Smart Cities Project”, Industrial Corridor Project, “Make in India”. • Increased manufacturing of blood and urine bags and other medical equipment as well during Covid-19.
North America	• Construction and commercial activities • High exports from USA. It is the largest PVC exporting country • Increased industrial construction activities owing to shifting of manufacturing units back to USA • Hindrance in supply chain • Expansion of new PVC and VCM manufacturing plants ▪ Shintech, subsidiary of Japan’s Shin-Etsu Chemical Co. has invested USD1.3 billion to expand its PVC manufacturing facilities at its Plaquemine, LA., site with an installed capacity of 380 thousand tonnes of PVC and 580 KTPA for the manufacturing of its precursor VCM. ▪ Formosa is scheduled to start a new 130 KTPA PVC production line at its Baton Rouge, LA plant in the 4th quarter 2022.
Europe	• Growth in construction activities coupled with increase in demand from automotive sector • Supply chain disruption • Volatile prices due to shortage of supply of PVC • Increasing demand for pipes, profiles, insulating materials
MEA and South America	• Multiple large scale infrastructure projects in MEA • Increasing usage of PVC pipes, cables and window profiles in housing, building and other infrastructural developments. • Heavy investment in downstream sector in South America

Global Polyvinyl Chloride (PVC) Demand, By Region, By Volume (000’ Tonnes), 2015–2030F



	2015	2020	2021E	2022F	2025F	2030F
Asia-Pacific	62.74%	62.05%	63.50%	63.72%	64.50%	65.75%
North America	11.15%	11.01%	11.04%	10.96%	10.60%	10.12%
Europe	10.12%	10.52%	10.54%	10.56%	10.32%	9.71%
Middle East & Africa	8.44%	8.62%	8.72%	8.64%	8.72%	8.98%
South America	7.55%	7.80%	6.20%	6.12%	5.86%	5.44%
Total	**40,987**	**43,090**	**44,908**	**46,635**	**51,632**	**60,177**

“Atmanirbhar Bharat” and “Make in India” policies are driving the domestic production

Source: TechSci Research

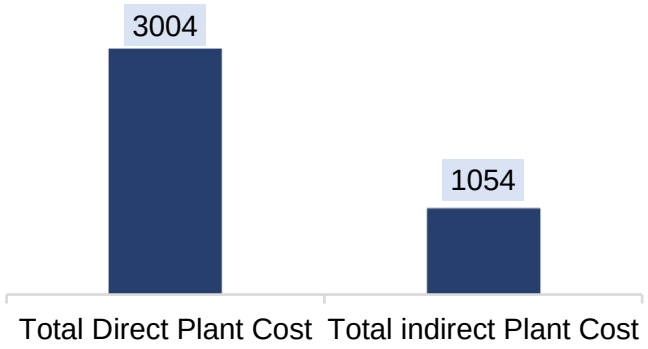
Financial Analysis: Plant Set-up

PVC

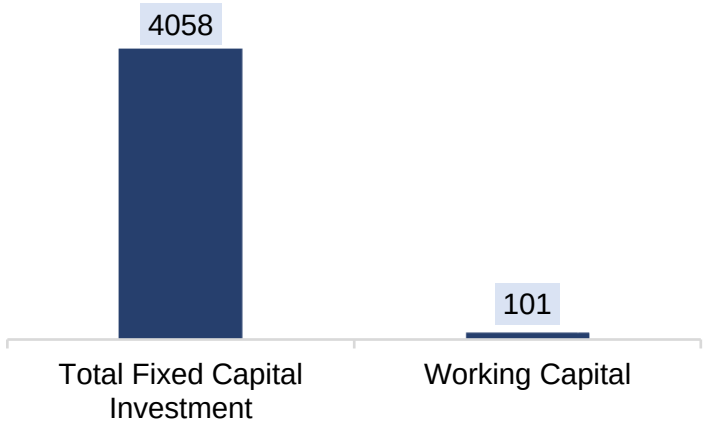
Plant Set-up: Capex

Option:1

Total Fixed Capital Investment: INR 4,058 Crore

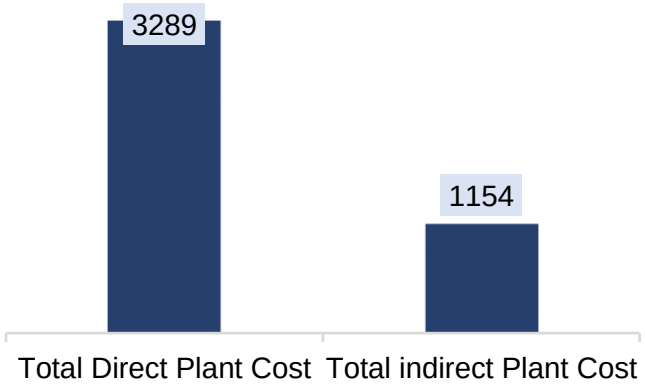


Total Capital Investment: INR 4,159 Crore

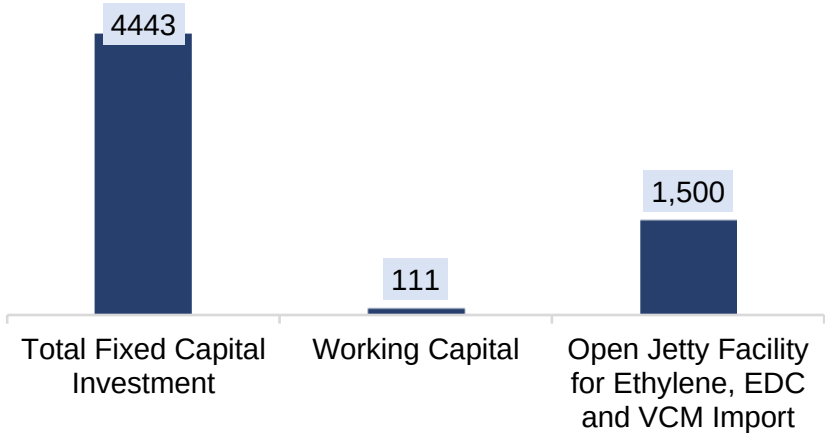


Option:2

Total Fixed Capital Investment: INR 4,443 Crore

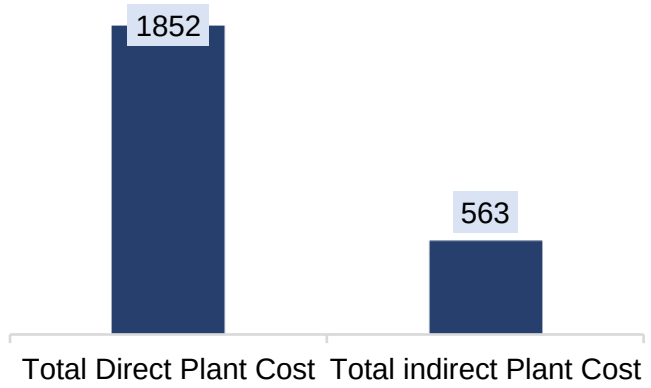


Total Capital Investment: INR 6,053 Crore

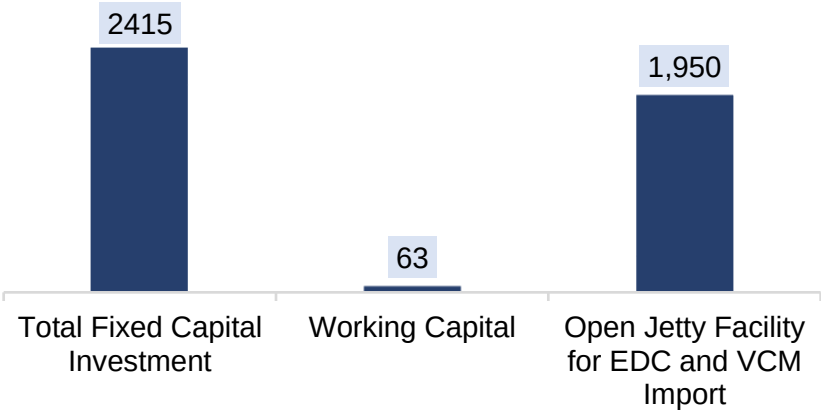


Option:3

Total Fixed Capital Investment: INR 2,415 Crore



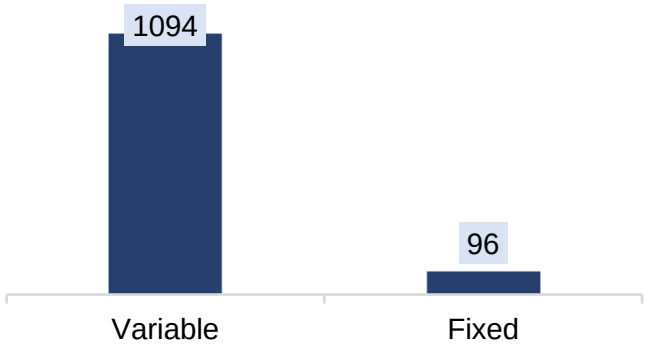
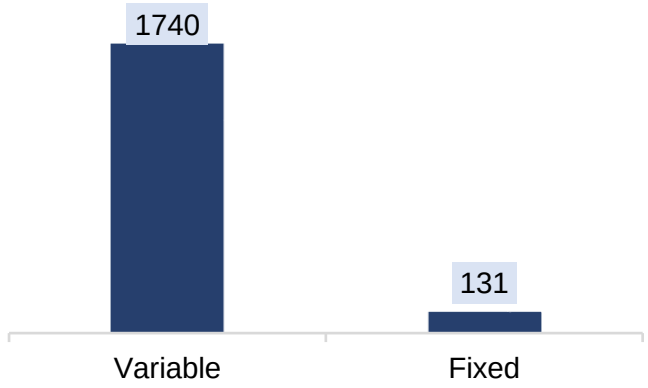
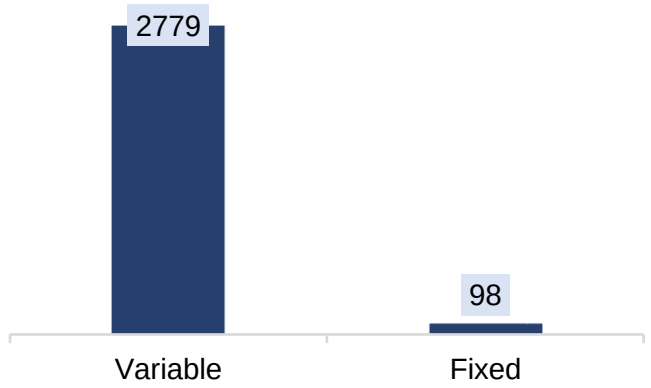
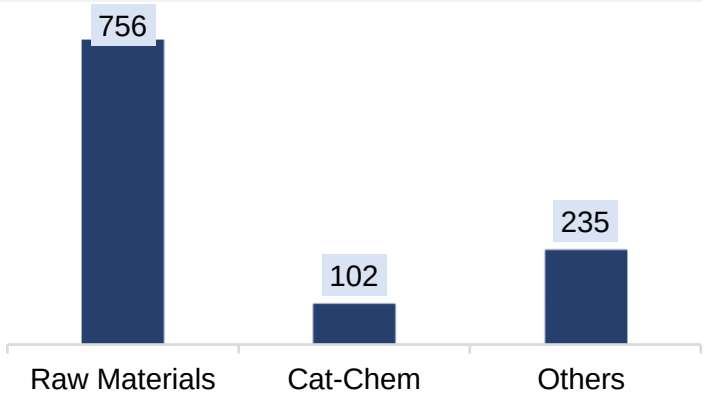
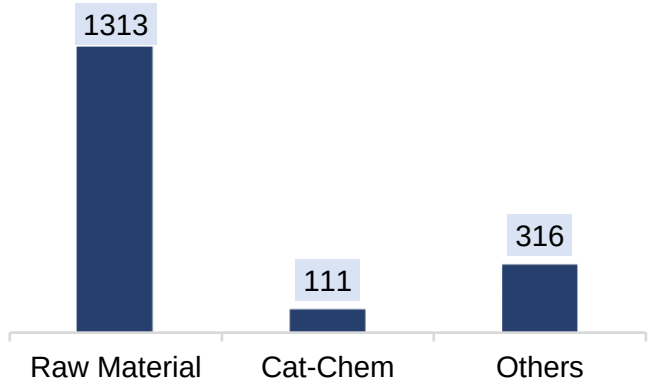
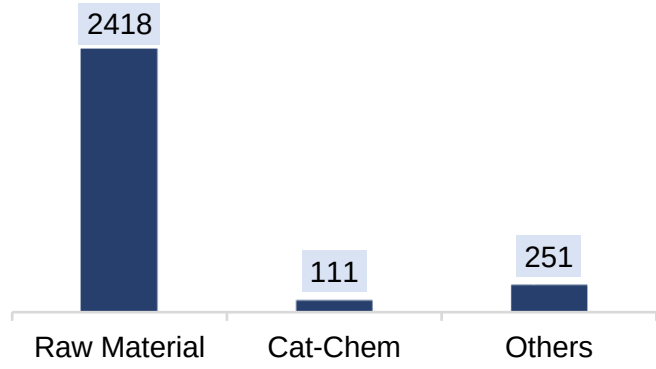
Total Capital Investment: INR 4,428 Crore



350 KTPA PVC + Captive Ethylene	500 KTPA PVC (350 KTPA (captive ethylene)+150 KTPA(EDC / VCM Outsourced)	500 KTPA EDC / VCM to PVC, EDC / VCM Outsourced

PVC

Plant Set-up: Opex

Option:1	Option:2	Option:3
Total Production Cost INR 1,190 Crore	**Total Production Cost : INR 1,871 Crore**	**Total Production Cost : INR 2,877 Crore**
		
Total Variable Cost: INR 1,094 Crore	**Total Variable Cost: INR 1,740 Crore**	**Total Variable Cost: INR 2,779 Crore**
		

Others include Variable and Selling Overheads

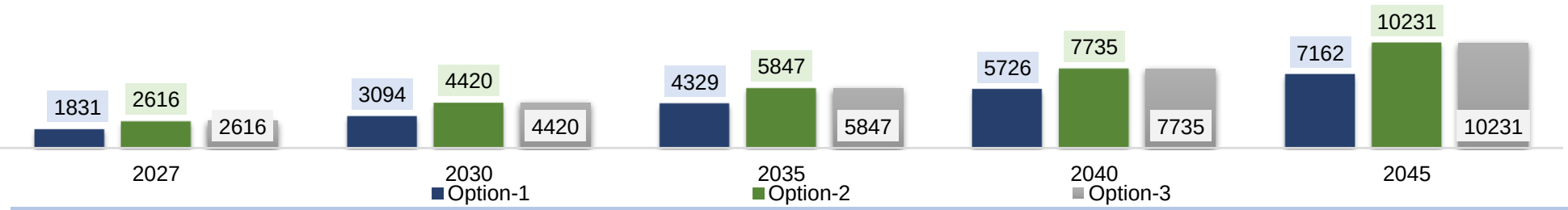
350 KTPA PVC + Captive Ethylene	500 KTPA PVC (350 KTPA (Captive Ethylene)+150 KTPA(EDC / VCM Outsourced)	500 KTPA EDC / VCM to PVC, EDC / VCM Outsourced

PVC

Plant Set-up: Operating Revenue, Operating Cost, Gross Margin

Operating Revenue

Note: All figures are in INR Crores

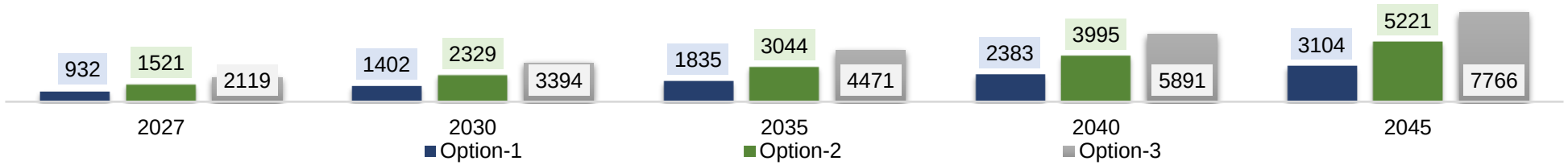


Option 1: Lower operating revenue because of lower capacity

Option 2 & 3 : Same operating revenue because both has the same capacity

Operating Cost

Note: All figures are in INR Crores

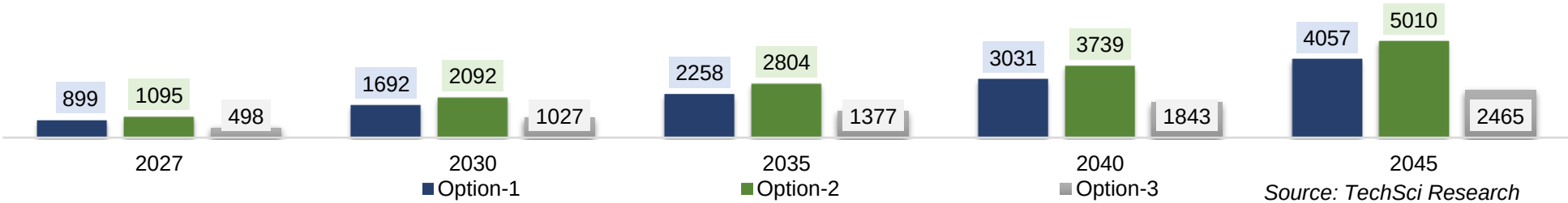


Option 1 : Inhouse production of feedstock offers an advantage of lowest operating cost

Option 2 & 3 :Higher operating cost because of higher capacity and EDC/VCM outsourcing.

Gross Margin

Note: All figures are in INR Crores



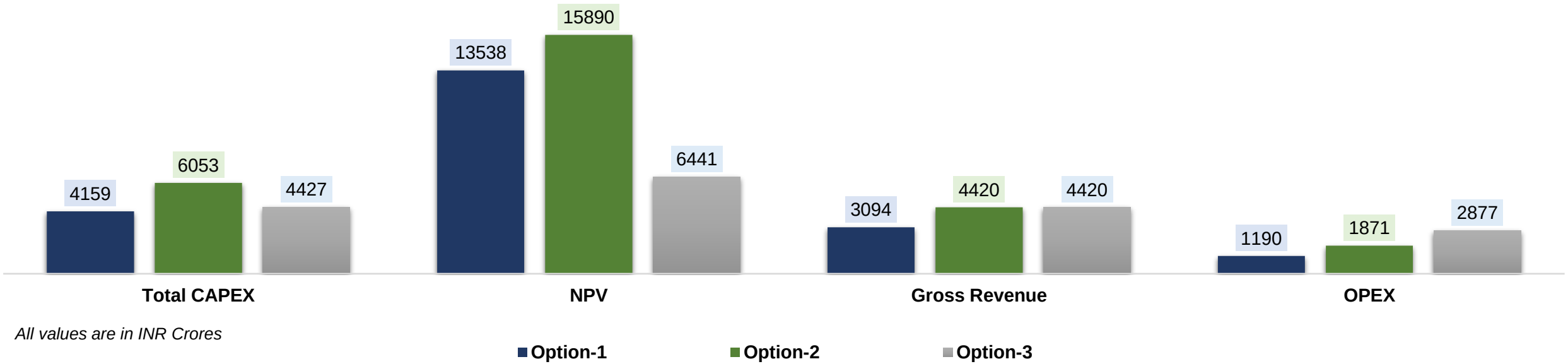
Gross Margins in option 1 and 2 are improved in comparison to 3, because of the spread between PVC and EDC / VCM.

Source: TechSci Research

350 KTPA PVC + Captive Ethylene | **500 KTPA PVC (350 KTPA (Captive Ethylene)+150 KTPA(EDC / VCM Outsourced)** | **500 KTPA EDC / VCM to PVC, EDC / VCM Outsourced**

PVC

Plant Set-up: Summary



All values are in INR Crores

Project Sensitivity Analysis

S.No.	Project Sensitivity	Profit After Tax Option-1
	Profit After Tax (at optimum capacity utilization)	Nil
1	Selling Price decreases by 11%, Raw Material Price remains same	26% decrease
2	Increase in Raw Material price by 16.5 % with no change in selling price	11% decrease
3	Increase in raw material price by 9 % with decrease in selling price by 5%	18% decrease
4	Increase in Cost of Production by 14.5% with no change in selling price	15% decrease

350 KTPA PVC + Captive Ethylene | **500 KTPA PVC (350 KTPA (Captive Ethylene)+150 KTPA(EDC / VCM Outsourced)** | **500 KTPA EDC / VCM to PVC, EDC / VCM Outsourced**

PVC

Source: TechSci Research

Plant Set-up: Raw Material Availability—Relevant To Option 2 and Option 3

India Trade Import Details of VCM (2020), (000' Tonnes)

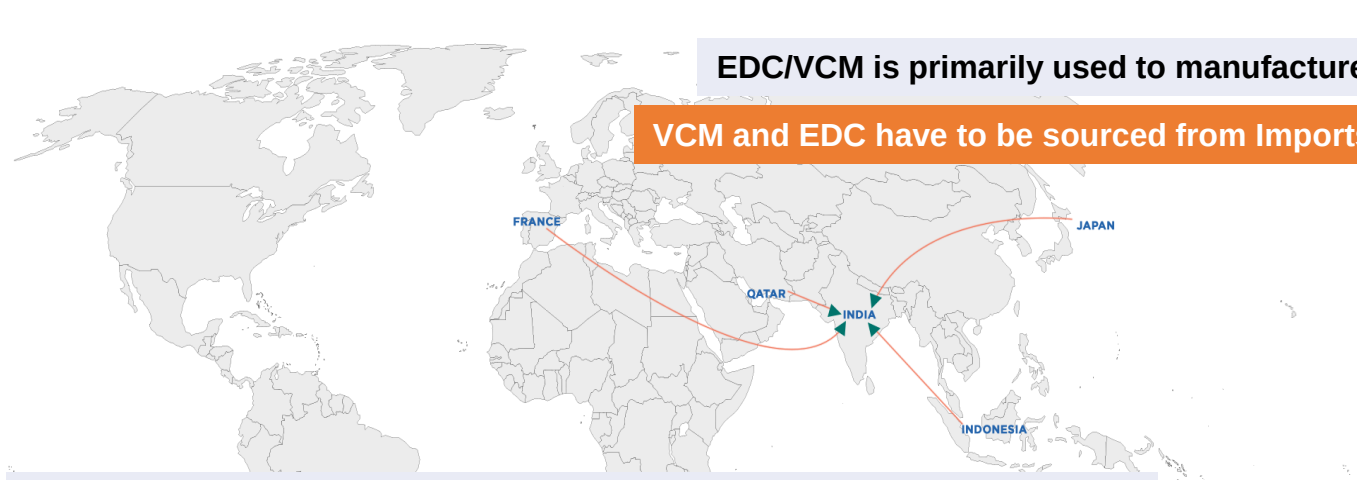
India Net VCM Import: 461 (000' Tonnes)

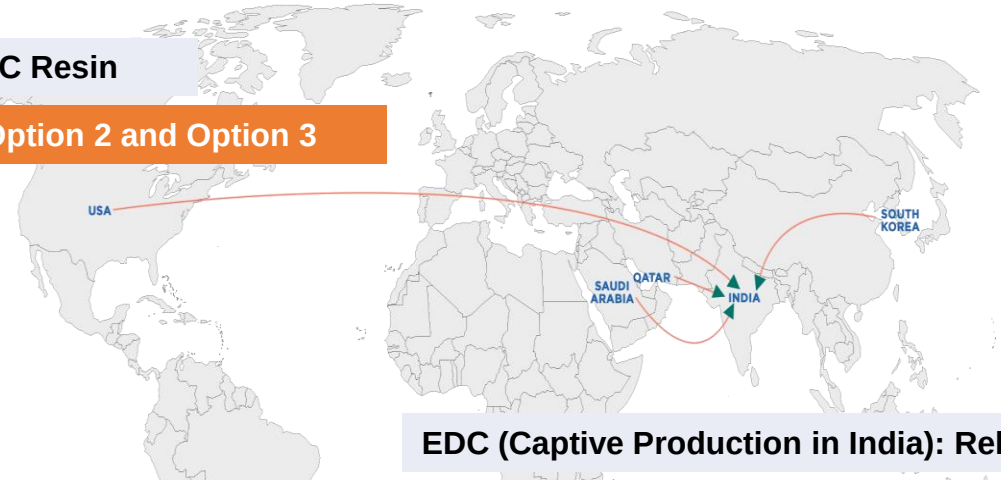
India Trade Import Details of EDC (2020), (000' Tonnes)

India Net EDC Import: 725 (000' Tonnes)

EDC/VCM is primarily used to manufacture PVC Resin

VCM and EDC have to be sourced from Imports : Option 2 and Option 3





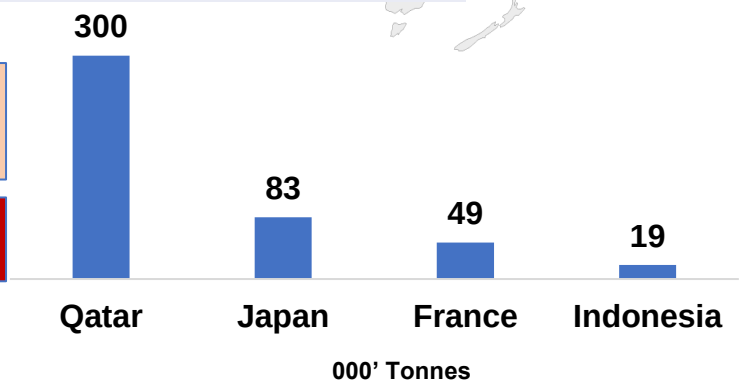
VCM (Captive Production in India): Reliance, Finolex, Chemplast, DCW

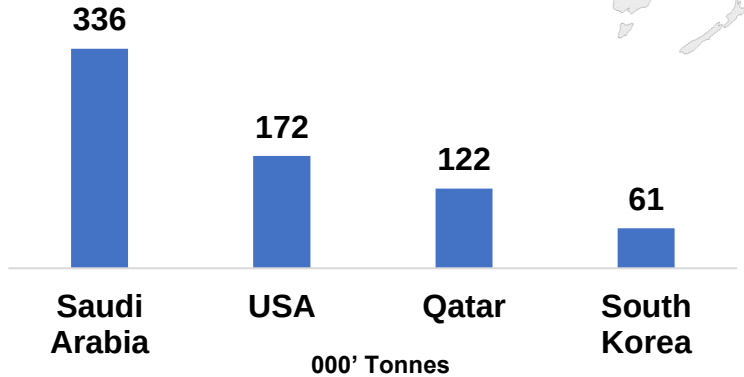
EDC (Captive Production in India): Reliance

Northeast Asia held the largest share: Production and consumption

Option 2: 500 KTPA PVC (350 KTPA from captive ethylene and 150 KTPA Through EDC / VCM Outsourced)

Option 3: 500 KTPA EDC / VCM to PVC, EDC / VCM Outsourced





Note: - The Import data is calculated for 2020 (calendar year from January 2020 to December 2020), India Import data vary as Import Export were taken from DGFT for Financial Year where FY 2021 means (April 2020 to March 2021).

Source: Department of Commerce, Ministry of Commerce and Industry, Government of India

Recommendations & Conclusions

PVC

Conclusions & Recommendations: Market Opportunity

All manufactures offer suspension grade

Finolex Industries Limited & Chemplast Sanmar Limited also offer emulsion grade

PVC price is primarily dependent on the fluctuating price of Ethylene / EDC/VCM

Overall, the PVC market will be more than approximately three times from 2870 Thousand MT in 2021 to 10,802 Thousand MT in 2040

Suspension Grade will always be the most prominent type :95% Demand

Pipes & Fittings will always be the most prominent end-use :73% Demand

Rigid PVC will always be is the most prominent type :85% Demand

West India+ South India will Continue to be the largest region: 70% Demand

Domestic Capacity Utilization: 89%

India is significantly (55%) imports dependent

Significant Exports Opportunity in Nearby Countries

Upcoming Greenfield / Brownfield Projects will intensity the competition

RIL—significant competitor: dedicated plants in Hazira. Vadodara. Also, expansion plans.

RIL Dahej unit is planning to add 1000 KTPA capacity in near vicinity which may result in oversupply condition in western region acting as a threat for OPaL.

Demand-Supply Gap (1733 KT in 2022 to 6752 KT in 2040) arguments the need for new player , even post-realization of ongoing/ upcoming Greenfield/ Brownfield Projects

Strategic location plays a vital role for OPaL, as the availability of chlorine is a significant challenge for players operating in the market. Therefore, OPaL can go for a long-term contract with caustic soda players operating in the region for the availability of chlorine. Gujarat Alkalies and Chemicals Limited, Meghmani Organics Limited and DCM Shriram Consolidated Limited are the leading players in the region.

Vinnolit K GmbH / Krupp Uhde (Low Cost of Production) , INEOS Technologies(Higher Yield), and Hanwha (All Grades) are recommended Technology Licensors

- A substantial business opportunity exists, but there would always be a threat of new players entering the market, specifically those companies with the advantage of in-house Ethylene. The early entrant will influence the entry plans of possible another entrant.
- OPAL can utilize a fully integrated unit to advantage as it has captive ethylene.

Conclusions & Recommendations: Most Suitable Plant Set-up Option

Features	Option 1	Option 2	Option 3
CapEx (INR Crore)	4159	6053	4427
OpEx (INR Crore)	1203	1884	2877
NPV (INR Crore)	13376	15727	6440
IRR	20.03%	17.43%	11.95%
Payback Period (Years) Simple	3.22	3.67	5.05
Propane (Raw material & Feed)	Propane through Parent Company ONGC	Propane through Parent Company ONGC	Not required
EDC/ VCM (Raw material & Feed)	Not Required	Required through Imports: 150KTPA	Required through Imports 500 KTPA
Chlorine Sourcing	Chlor-Alkali units (DCM Sriram, Meghmani, GACL) in proximity	Chlor-Alkali units (DCM Sriram, Meghmani, GACL) in proximity	Not Required
Jetty Facility	Not Required	Required	Required
Margin %(Starting from First Year of Operation	48.59%	41.48%	19.02%

	350 KTPA PVC + Captive Ethylene	500 KTPA PVC (350 KTPA (captive ethylene)+150 KTPA(EDC / VCM Outsourced)	500 KTPA EDC / VCM to PVC, EDC / VCM Outsourced
Preference Option Rank:	1	2	3

OPaL will have sufficient ethylene, propylene and benzene after commissioning the propane furnace. Therefore, Option 1 will have better NPV, IRR, Payback Period and margin despite having the highest CapEx

The Scenario 1 is most feasible in terms of execution and realization as it won't require EDC/VCM sourcing from the international market. The jetty facility will also be not needed.

PVC

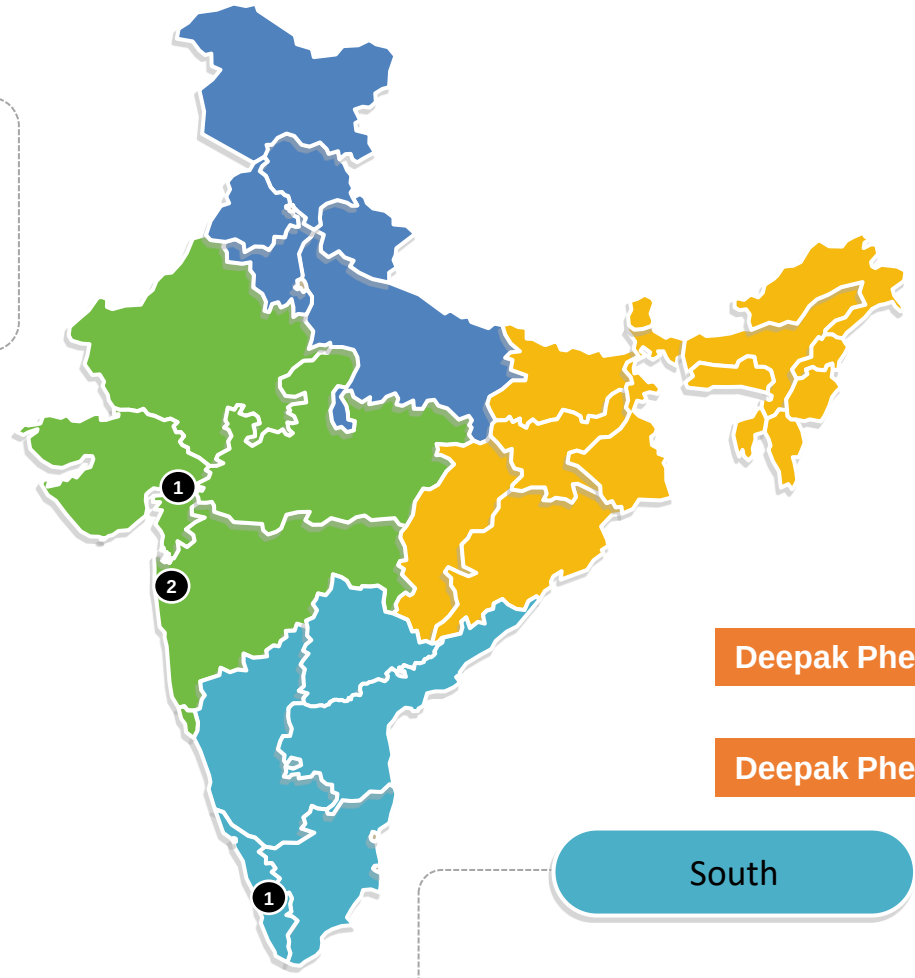
TechSci Research
from NOW to NEXT

Phenol

India: Manufacturing Landscape

West

1. Dahej, Deepak Phenolics
2. Navi Mumbai, SI Group India



South

1. Kochi, Hindustan Organic Chemicals Ltd.

India Phenol Capacity, By Company (000' Tonnes)

Company	Technology Provider	Capacity, FY2021
Deepak Phenolics Ltd.	Kellogg Brown & Root International Inc. (KBR) (For Phenol and Acetone) Honeywell UOP LLC (Cumene)	200
Hindustan Organic Chemicals Ltd.	Honeywell UOP LLC	42
SI Group India Ltd.	Honeywell UOP LLC	37

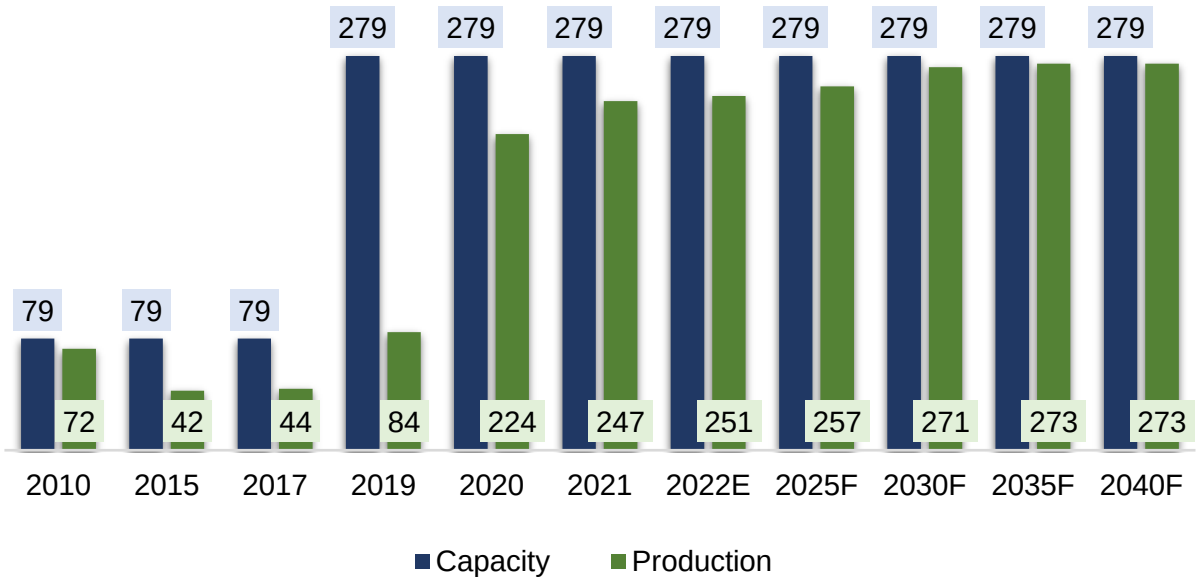
Deepak Phenolics has capacity of Cumene (captive consumption)

Deepak Phenolics has integrated unit to produce IPA from Acetone

Source: TechSci Research

India: Capacity, Production, Demand

India Phenol Capacity and Production, By Volume (000' Tonnes), 2010 - 2040F



Significant Imports: 42% Demand

Demand-Supply Gap arguments the need of a new player . No explanation /New plant announced, as of now.

Downstream integration opportunities exist to produce chemical like Bisphenol A, Isopropyl Alcohol, Ketoxime etc.

Well Established technology and production of cumene as intermediate and Acetone as by product add to volume and additional revenues in this segment.

India Phenol Demand Supply Scenario, 2010-2040F (000 Tonnes)

Parameters	2010	2015	2021	2022E	2025F	2030F	2035F	2040F
Capacity	79.00	79.00	279.00	279.00	279.00	279.00	279.00	279.00
Production	71.82	42.12	246.90	250.70	257.35	271.05	273.42	273.42
Import	112.40	199.68	170.62	148.73				
Export	0.40	1.50	51.05	44.65				
Inventory	4.50	3.12	4.94	2.56				
Demand	179.00	237.00	362.00	352.00	429.00	584.00	811.00	1136.00
Y-O-Y Growth Rate, %		2.99%	9.91%	-2.58%	6.50%	6.80%	6.90%	7.01%
Demand - Supply Gap				-102	-171	-313	-537	-863

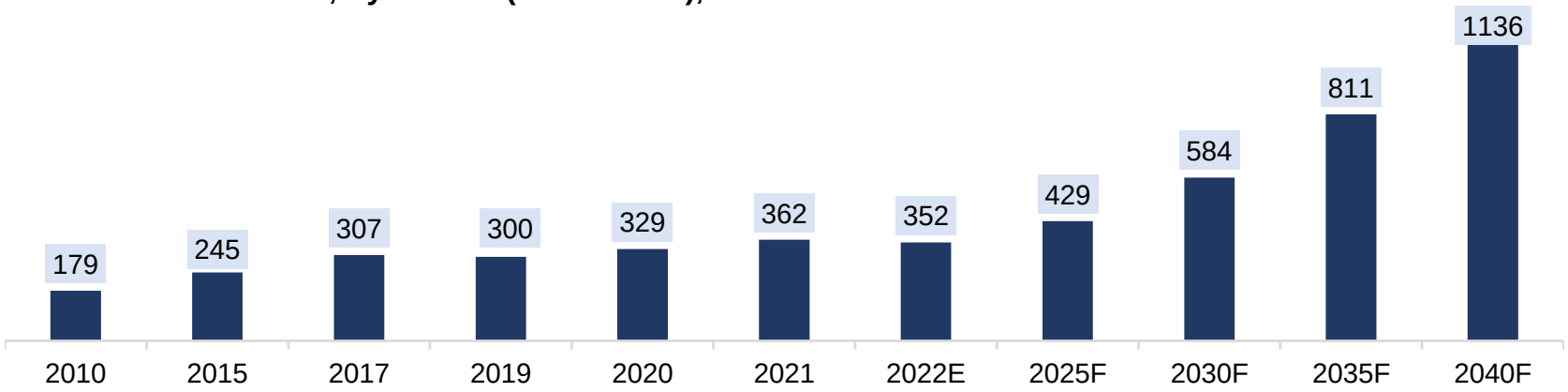
India Acetone Demand Supply Scenario, 2010-2040F (000 Tonnes)

Parameters	2010	2015	2021	2022E	2025F	2030F	2035F	2040F
Capacity	45.00	45.00	169.00	169.00	169.00	169.00	169.00	169.00
Production	44.00	26.00	149.00	152.00	155.00	164.00	165.00	165.00
Import	80.00	127.00	82.00	101.00				
Export	0.50	3.18	28.16	34.00		-		
Inventory	0.89	0.52	2.99	3.03				
Demand	123.00	149.00	200.00	216.00	262.00	358.00	474.00	605.00
Y-O-Y Growth Rate, %	-	3.49%	3.18%	8.05%	6.22%	6.88%	5.52%	4.71%
Demand - Supply Gap				-65	-106	-194	-309	-440

Source: TechSci Research

India: Demand—Phenol

India Phenol Demand, By Volume (000' Tonnes), 2010-2040F

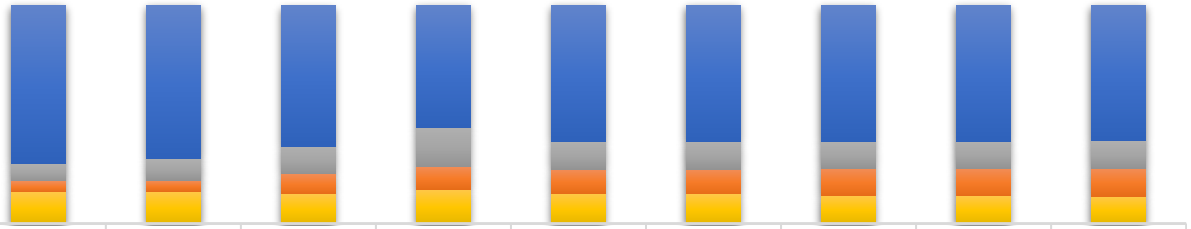


CAGR 2010-2021	CAGR 2022E-2030F	CAGR 2031F-2040F
6.58%	6.54%	6.91%

Major players are Deepak Phenolics Ltd, Hindustan Organic Chemicals Ltd. and SI Group India Ltd.

India Phenol Demand, By End Use, By Volume (000' Tonnes), FY 2010– FY 2040F

Phenol Formaldehyde Resin is the most prominent end-use



	2010	2015	2020	2021	2022E	2025F	2030F	2035F	2040F
Phenol Formaldehyde Resin	72.26%	70.27%	64.65%	56.13%	62.37%	62.44%	62.60%	62.35%	62.15%
Pharmaceuticals	8.20%	9.84%	12.45%	17.57%	12.90%	12.61%	12.12%	12.35%	12.53%
Bisphenol-A	4.98%	5.09%	9.35%	10.63%	10.82%	11.41%	12.39%	12.55%	12.74%
Others	14.56%	14.80%	13.55%	15.67%	13.91%	13.54%	12.89%	12.75%	12.58%
Total	**179**	**237**	**329**	**362**	**352**	**429**	**584**	**811**	**1136**

Phenol Formaldehyde resin accounts to nearly 70% of the total demand in India

Growing demand of Bisphenol- A is one of the major drivers

Honeywell UOP, The Kellogg Brown & Root (KBR) Technology, Lummus Phenol Technology, Badger Acetone -to- Cumene (ATC) Technology are the major technology providers for Phenol and Acetone manufacturing

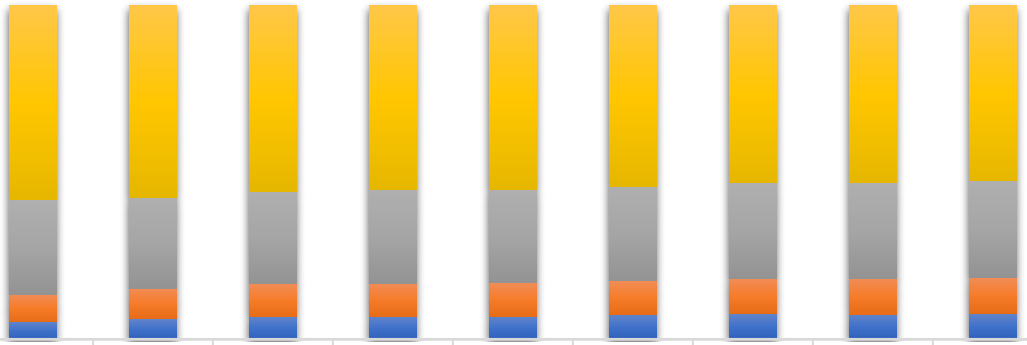
Others include Caprolactam, Aniline, Cyclohexanone, etc

Source: TechSci Research

India: Demand—Phenol

India Phenol Demand, By Region, By Volume (000' Tonnes), FY 2010– FY 2040F

West India is the largest region



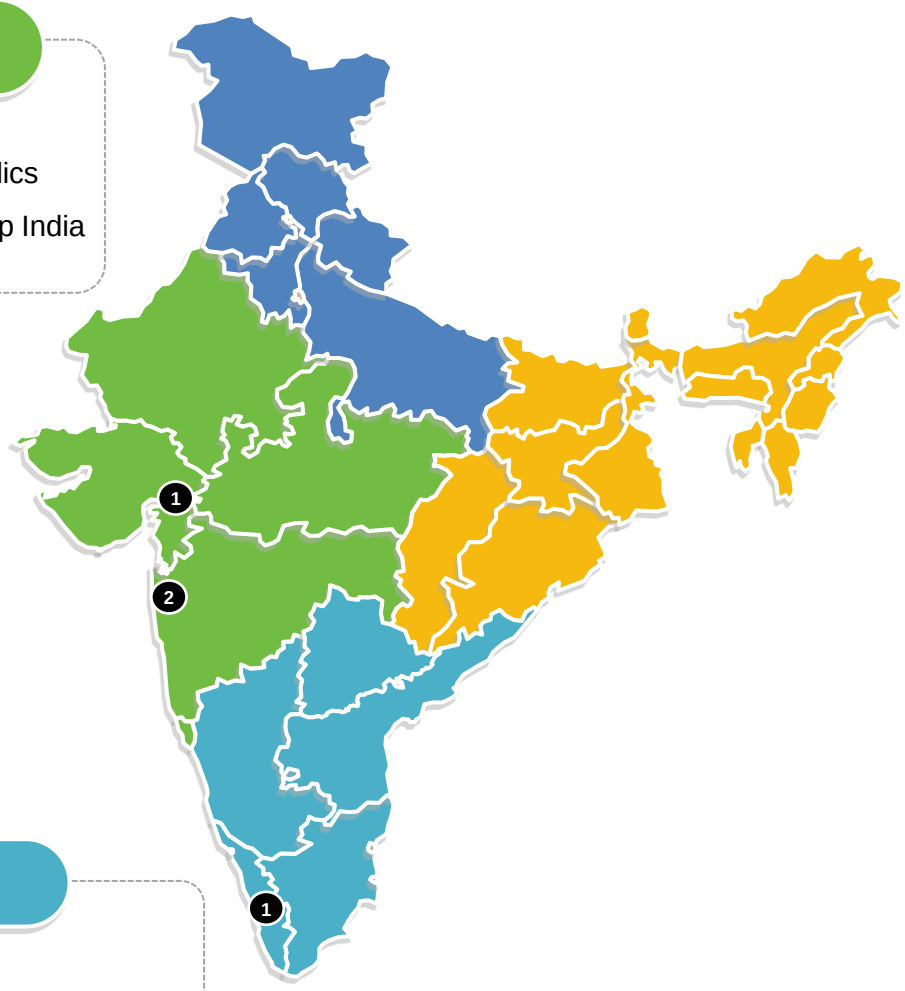
	2010	2015	2020	2021	2022E	2025F	2030F	2035F	2040F
West	58.23%	57.48%	55.61%	55.27%	55.11%	54.21%	53.12%	52.88%	52.50%
South	28.21%	27.20%	27.80%	27.91%	27.98%	28.25%	28.61%	28.80%	28.97%
North	8.30%	9.21%	9.81%	9.92%	9.96%	10.28%	10.64%	10.81%	10.94%
East	5.26%	6.11%	6.78%	6.90%	6.95%	7.26%	7.63%	7.51%	7.59%
Total	**179**	**237**	**329**	**362**	**352**	**429**	**584**	**811**	**1136**

West India+South India: ~83% of the total demand

End-Use Sectors : Pharmaceuticals and construction

West

1. Dahej, Deepak Phenolics
2. Navi Mumbai, SI Group India



South

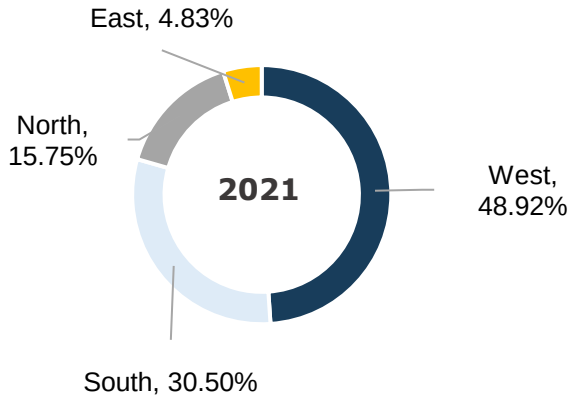
1. Kochi, Hindustan Organic Chemicals Ltd.

Source: TechSci Research

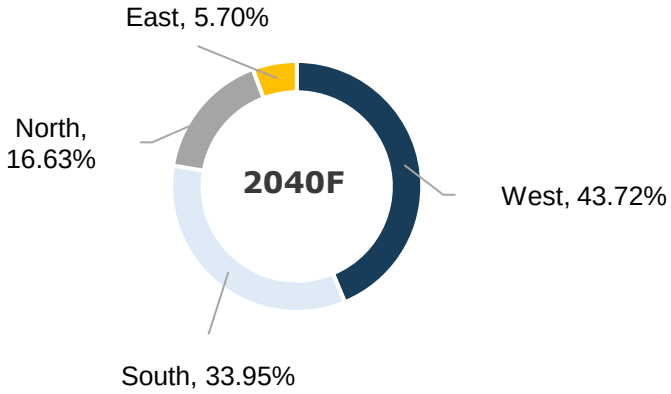
India: Demand—Acetone

India Acetone Demand, By Market Share, By Region, FY2021 & FY2040 (%)

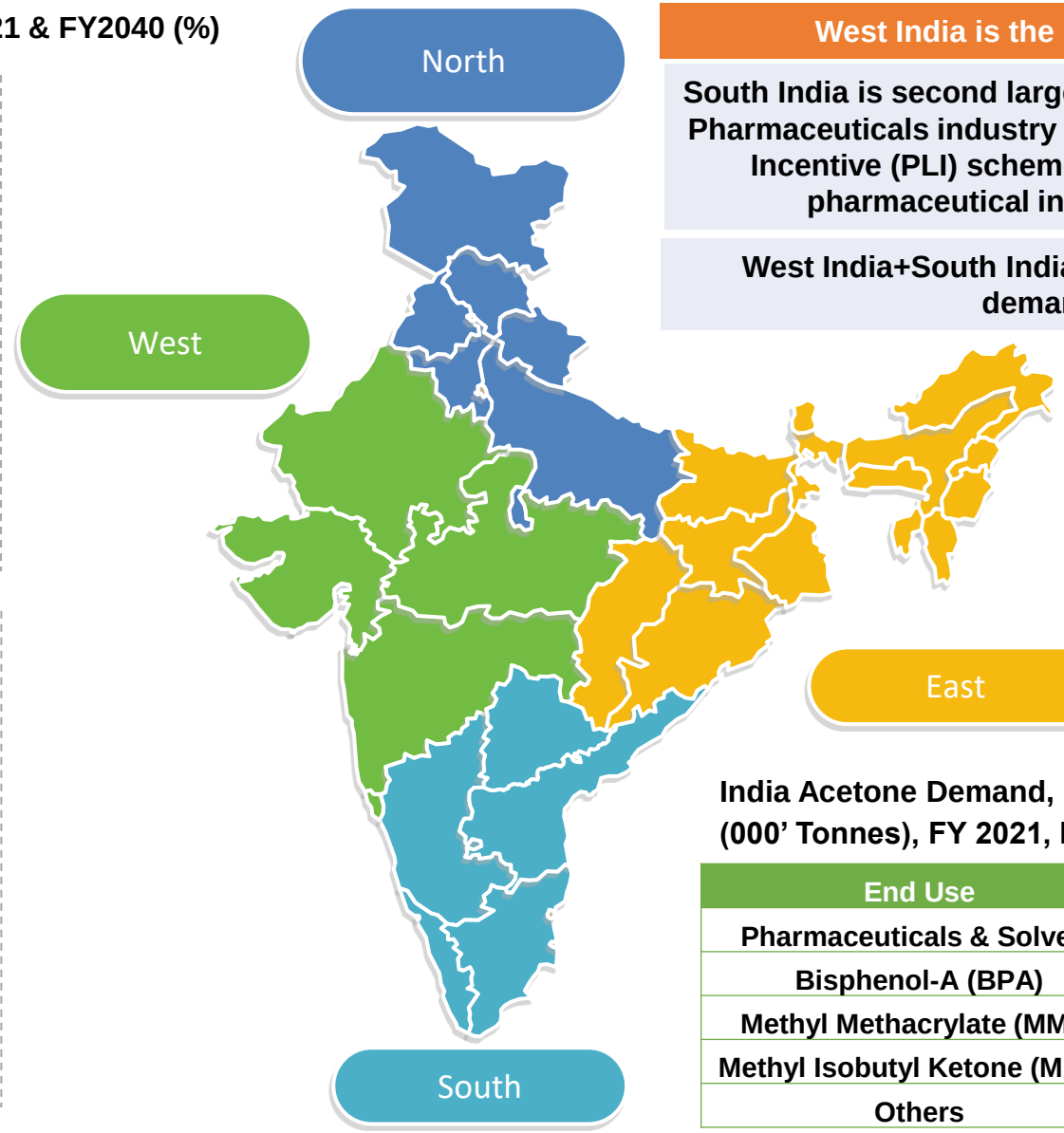
India Acetone Demand, By Market Share, By Region, FY2021 (%)



India Acetone Demand, By Market Share, By Region, FY2040 (%)



Source: TechSci Research



West India is the largest region

South India is second largest because of growing Pharmaceuticals industry and Production Linked Incentive (PLI) scheme to encourage the pharmaceutical industry growth.

West India+South India: ~80% of the total demand

India Acetone Demand, By End Use, By Volume (000' Tonnes), FY 2021, FY 2040F

End Use	FY 2021	FY 2040
Pharmaceuticals & Solvent	61.46%	55.23%
Bisphenol-A (BPA)	12.04%	16.83%
Methyl Methacrylate (MMA)	11.55%	10.48%
Methyl Isobutyl Ketone (MIBK)	10.10%	11.59%
Others	4.85%	5.87%

India: Trade, Exports (Opportunity)

Export Potential Market of Phenol

Countries	2020		
	Import	Export	Net Export Potential
China	709.92	17.29	692.63
Taiwan	105.56	180.52	-74.96
Thailand	40.08	225.11	-185.03
Malaysia	22.73	0.25	22.48
Indonesia	17.14	0.27	16.87

Note: Import and export volumes are in thousand tonnes

Present Scenario of Anti-Dumping Duty (ADD)

Countries	Quantum of Duty imposed	Remarks
USA	USD 250 per MT - USD 350 per MT	
Thailand	USD 250 per MT - USD 350 per MT	
South Korea	US$ Nil to 253.06 per MT	Removed effective from 31/10/2021
European Union	US$ Nil to 253.06 per MT	Removed effective from 31/10/2021
Singapore	US$ Nil to 253.06 per MT	Removed effective from 31/10/2021

Significant Exports Opportunity in Nearby Countries

India may be a significant exporter of Phenol and Acetone. OPaL can replicate the exports business model of Deepak Phenolics (Only Exporter) and, in the proximity of OPaL

Antidumping duty levied on imports of Phenol from Thailand and USA

18% GST on Phenol traded within the country

7.5% custom duty imposed on Import

10% social welfare surcharge on Phenol

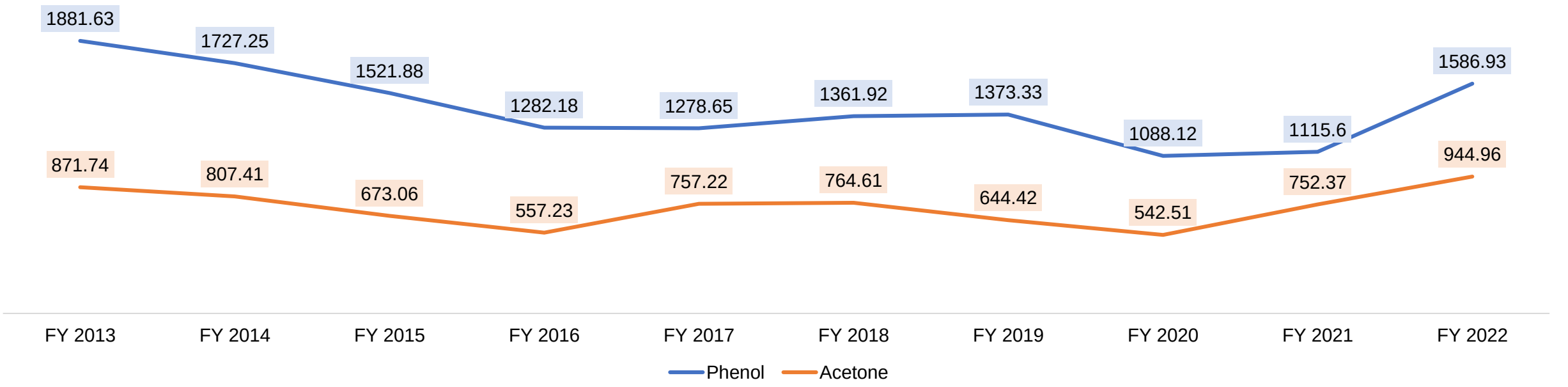
Phenol HS Code: 29071110

Source: - Department of Commerce, Ministry of Commerce and Industry, Government of India, UN Comtrade

India: Pricing (Average) Trend

India Phenol & Acetone Historical prices (FY 2013-FY 2022) (USD/MT)

Upward price trend is observed from 2021 onwards



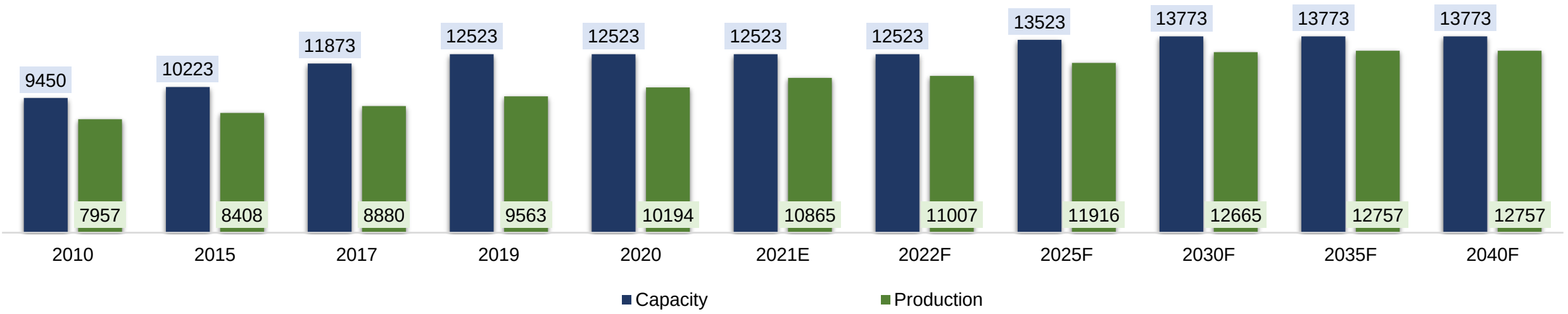
Phenol price is primarily dependent on the fluctuating price of Propylene, Benzene and Cumene

Acetone price is driven by market conditions and production of phenol

Source: TechSci Research

Global: Capacity, Production

Global Phenol Capacity and Production, By Volume (000' Tonnes), 2010 - 2040F



India contributes ~2% of the global phenol capacity in FY2020

- INEOS Group, Cepsa Corporation, Kumho Chemicals, LG Chem are the leading global producers of Phenol.
- Ineos group operates phenol and acetone plants at sites in Gladbeck, Germany; Antwerp, Belgium; and Mobile, Alabama in the United States. All three sites use their own proprietary technology.
    - In Europe, the major competitors for Ineos group are Cepsa, Novapex, Borealis and Versalis.
    - In North America, major competitors are Shell and Honeywell.
    - Has consumers globally, including Covestro (previously Bayer), Olin (previously Dow), Sabic, Fibrant (previously DSM), Evonik and Lucite.

Source: TechSci Research

Capacity by Location, 000' Tonnes

Location	Companies	2010	2015	2021E	2022F	2025F	2030F	2035F	2040F
USA	Ineos Group Ltd, Advansix, Shell Chemicals, SABIC Innovative Plastics, Altivia Petrochemicals, Olin Corporation, Georgia Gulf Corporation	2422	2422	2572	2572	2882	2882	2882	2882
China	Ineos Group Ltd, Cepsa Corporation, Zhejiang Rongsheng, Chang Chun Chemical, Shanghai Sinopec Mitsui, CNOOC Huizhou	250	800	1820	1820	1820	1820	1820	1820
South Korea	Kumho P&B Chemicals., Inc., LG Chem	980	980	1280	1280	1280	1280	1280	1280
Taiwan	Formosa Chemical and Fibre, Taiwan Prosperity Chemical Corp., Chang Chun Plastic	960	960	960	960	1060	960	960	960
Belgium	Ineos Group Ltd	680	680	680	680	680	680	680	680
Others		4158	4381	5211	5211	5801	6151	6151	6151
Total		9450	10223	12523	12523	13523	13773	13773	13773

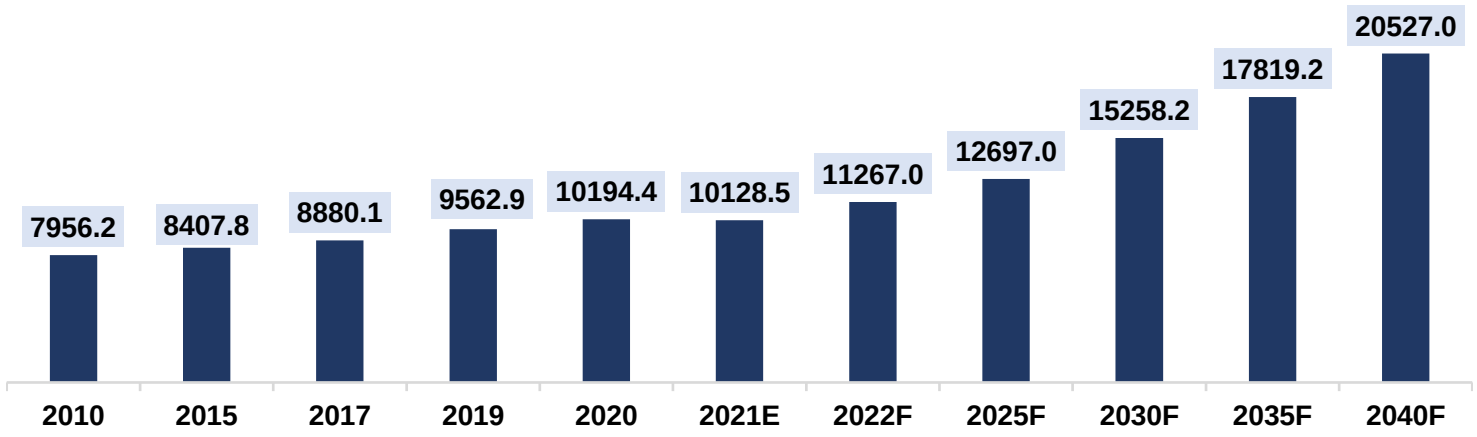
Major Expansions for the Manufacturing of Cumene, Phenol and Acetone, By Location

Company	Licensor	Product	Capacity (000' Tonne)	Location	Likely Year of Commissioning
Formosa Chemicals and Fibre Corp	Lummus Technology	Cumene, Phenol & Acetone	400	Nimbo, China	2025
PKN Orlen	UOP's Q-Max	Cumene, Phenol & Acetone	200	Plock, Poland	2024
PKN Orlen	Badger	Acetone and Isopropanol	140	Plock, Poland	2024
Reliance Industries Ltd	NA	Cumene, Phenol & Acetone	200	Jamnagar, Gujarat	Planning Stage Only
Ineos Group	Ineos	Cumene	750	Marl, Germany	2022
Haiwan Chemical	KBR	Cumene, Phenol & Acetone	320	Shandong, China	2024

Source: TechSci Research

Global: Demand- Phenol

Global Phenol Demand, By Volume (000' Tonnes), 2010-2040F



CAGR 2010-2021	CAGR 2022E-2030F	CAGR 2031F-2040F
3.1%	3.9%	3.0%

India contributes~3% of the global phenol market demand (FY2020)

Growth in construction, automotive and infrastructure sectors supports phenol demand

Global Phenol Demand Supply Scenario, 2010-2040F, (000 Tonnes)

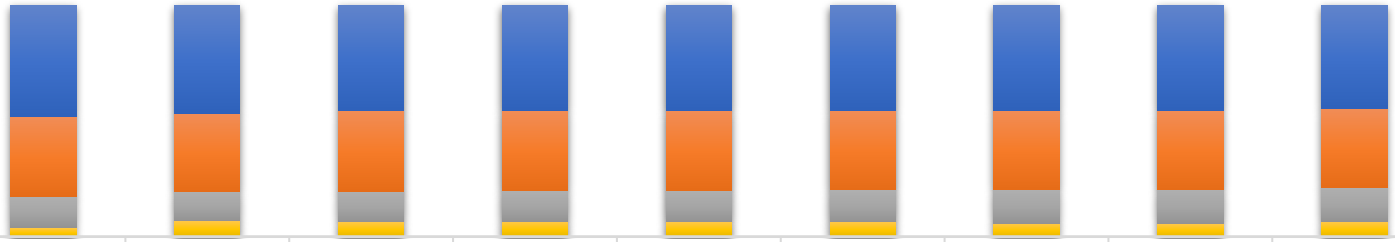
Parameters	2010	2015	2021E	2022F	2025F	2030F	2035F	2040F
Capacity	10,223.00	10,223.00	12,523.00	12,523.00	13,523.00	13,773.00	13,773.00	13,773.00
Production	7,956.00	8,408.00	10,865.00	11,007.00	11,916.00	12,665.00	12,757.00	12,757.00
Demand	7,956.24	8,407.84	10,828.50	11,267.00	12,697.00	15,258.20	17,819.20	20,527.31
Y-O-Y Growth Rate, %		4.99%	6.22%	4.05%	3.82%	3.39%	3.36%	2.80%
Demand - Supply Gap			36.00	-260.00	-781.00	-2,593.00	-5,062.00	-7,770.00

Source: TechSci Research

Global: Demand- Phenol

Global Phenol Demand, By End Use, By Volume (000' Tonnes), 2010–2040F

Bisphenol-A is the most prominent end-use



	2010	2015	2020	2021E	2022F	2025F	2030F	2035F	2040F
Bisphenol-A	48.15%	46.60%	45.73%	45.58%	45.54%	45.35%	45.39%	45.50%	44.79%
Phenolic Resin	34.74%	33.93%	34.59%	34.51%	34.49%	34.45%	34.21%	34.25%	33.81%
Pharmaceuticals	13.11%	12.50%	13.22%	13.30%	13.43%	13.91%	14.57%	14.60%	14.84%
Others	4.00%	6.97%	6.46%	6.61%	6.54%	6.29%	5.84%	5.65%	6.56%
Total	**7956.24**	**8407.84**	**10194.37**	**10828.46**	**11267.01**	**12696.97**	**15258.16**	**17819.23**	**20527.31**

India contributes~1% of the global BPA market demand (FY2020)

Manufacturing of polycarbonate and epoxy resin is expected to drive the Bisphenol A (BPA) demand

Epoxy resins are used manufacturing in adhesives, fillings, and composite materials.

Global Phenol Demand, By Region, By Volume (000' Tonnes), 2010–2040F

Asia-Pacific is the most prominent region

	2010	2015	2020	2021E	2022F	2025F	2030F	2035F	2040F
Asia-Pacific	51.72%	51.04%	52.84%	53.05%	53.25%	53.80%	54.72%	56.05%	56.72%
Europe	21.24%	20.00%	19.75%	19.70%	19.65%	18.80%	17.86%	17.55%	16.84%
North America	16.50%	17.05%	16.04%	16.62%	17.05%	16.93%	17.23%	16.55%	15.53%
Middle East & Africa	6.15%	5.72%	6.82%	6.91%	6.72%	6.91%	6.12%	6.55%	6.71%
South America	4.39%	6.19%	4.55%	3.72%	3.33%	3.56%	4.07%	3.30%	4.20%
Phenol	**7956.24**	**8407.84**	**10194.37**	**10828.46**	**11267.01**	**12696.97**	**15258.16**	**17819.23**	**20527.31**

India contributes ~6% of the APAC phenol market demand in FY2020

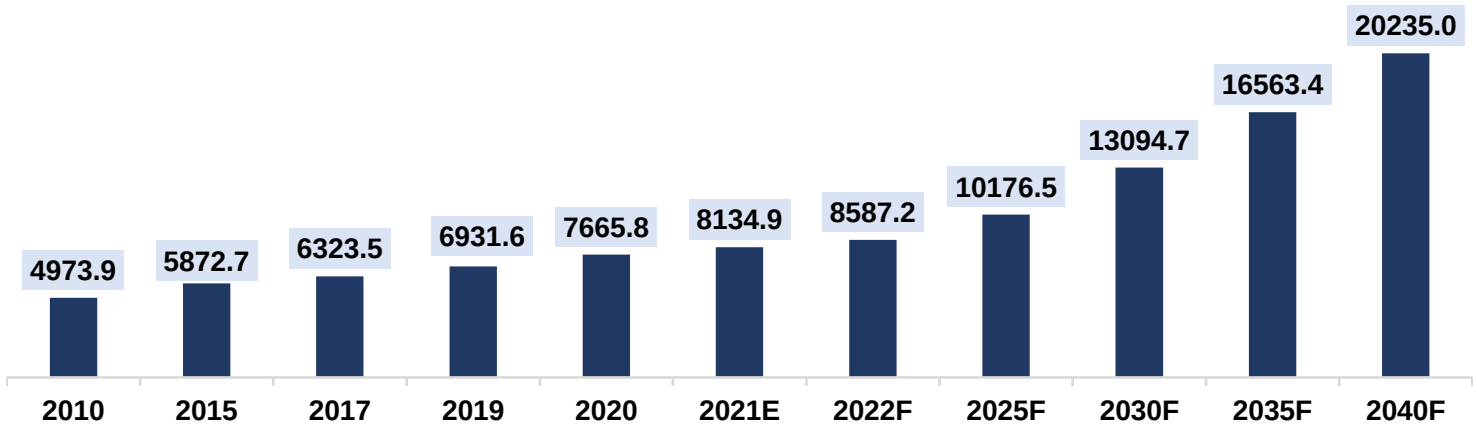
Phenolic Resin is the largest derivative in the APAC region, holding approximately 41% of total consumption

Phenolic resins are widely used as a binding and insulating material

Source: TechSci Research

Global: Demand- Acetone

Global Acetone Demand, By Volume (000' Tonnes), 2010-2040F



CAGR 2010-2021	CAGR 2022E-2030F	CAGR 2031F-2040F
4.6%	5.4%	4.4%

India contributes~2% of the global acetone market demand (FY2020)

Growth in pharmaceutical, automotive and solvent based products like thinners supports phenol demand

Global Acetone Demand Supply Scenario, 2010-2040F, (000' Tonnes)

Parameters	2010	2015	2021E	2022F	2025F	2030F	2035F	2040F
Capacity	5084.4	6265.8	7513.8	7513.8	8113.8	8263.8	8263.8	8263.8
Production	4973.9	5872.7	7790.2	8175.5	9256.8	11248.4	13516.8	16083.9
Demand	4973.9	5872.7	8134.9	8587.2	10176.5	13094.7	16563.4	20235.0
Y-O-Y Growth Rate, %		4.64%	6.12%	5.56%	5.94%	4.94%	4.72%	3.72%
Demand - Supply Gap			-344.7	-411.8	-919.7	-1846.3	-3046.6	-4151.1

Source: TechSci Research

Global: Demand- Acetone

Global Acetone Demand, By End Use, By Volume (000' Tonnes), 2021 & 2040F

Pharmaceuticals & Solvent is the most prominent end-use

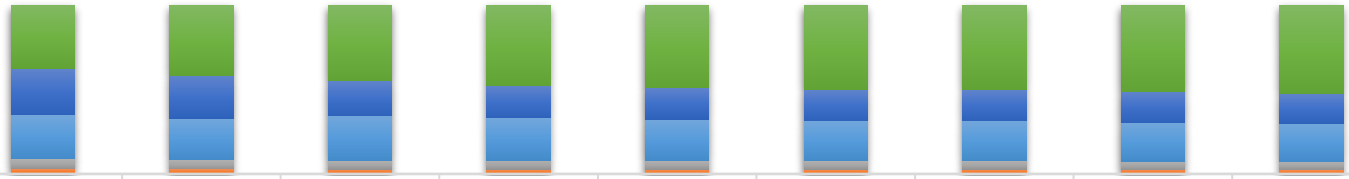
End Use	2021	2040
Pharmaceuticals & Solvent	40.61%	42.03%
Bisphenol-A (BPA)	24.85%	22.13%
Methyl Methacrylate (MMA)	14.63%	16.15%
Methyl Isobutyl Ketone (MIBK)	12.71%	11.43%
Others	7.20%	8.26%

China contributes~18% of the global acetone market demand (FY2020)

Manufacturing of Bisphenol-A and IPA will drive the future demand

Global Acetone Demand, By Region, By Volume (000' Tonnes), 2010–2040F

Asia-Pacific is the most prominent region



	2010	2015	2020	2021E	2022F	2025F	2030F	2035F	2040F
Asia-Pacific	37.08%	41.31%	44.34%	47.31%	48.40%	49.69%	49.69%	50.97%	52.21%
Europe	27.69%	25.62%	21.02%	19.44%	19.01%	18.70%	18.70%	18.35%	17.95%
North America	26.38%	24.70%	26.69%	25.10%	24.60%	23.78%	23.78%	23.04%	22.41%
Middle East & Africa	5.71%	5.42%	5.20%	5.32%	5.22%	5.12%	5.12%	4.99%	4.85%
South America	3.13%	2.95%	2.76%	2.83%	2.77%	2.72%	2.72%	2.65%	2.58%
Phenol	**4973.9**	**5872.7**	**7665.8**	**8134.9**	**8587.2**	**10176.5**	**13094.7**	**16563.4**	**20235.0**

India contributes ~5% of the APAC acetone market demand in FY2022

In China and India, Acetone is used for the manufacturing of vitamins API and antibiotics (cephalosporins).

Source: TechSci Research

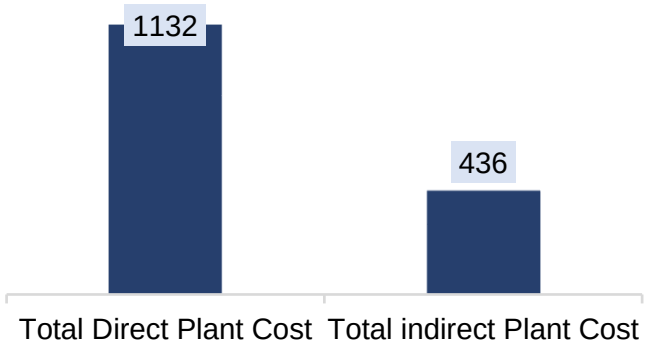
Financial Analysis: Plant Set-up

Phenol

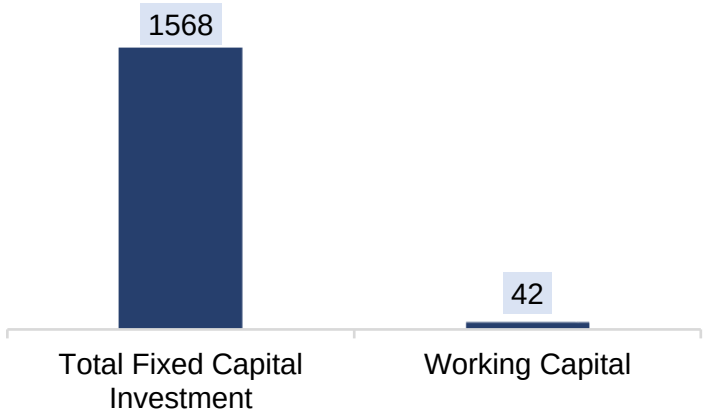
Plant Set-up: Capex

Option-1

Total Fixed Capital Investment: INR 1,568Crore



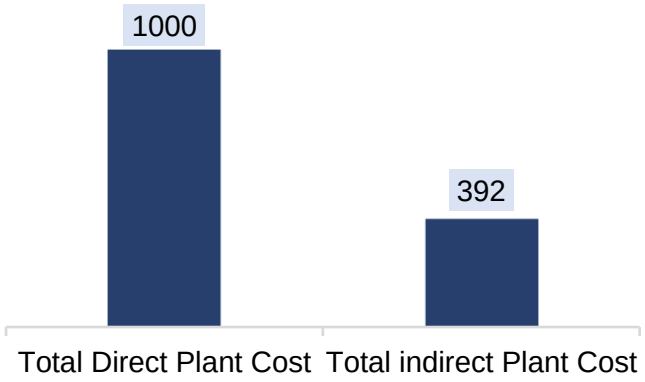
Total Capital Investment: INR 1,769 Crore



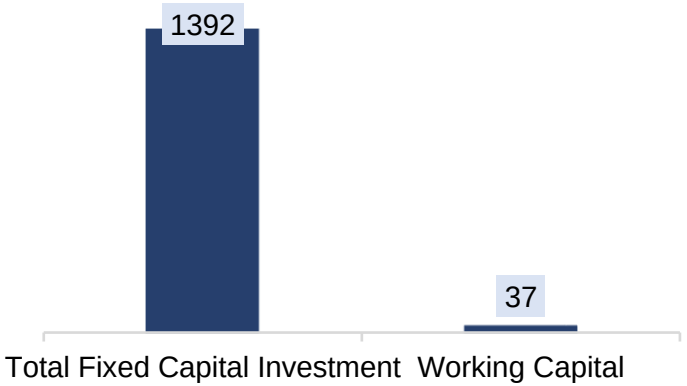
200 KTPA Phenol+120 KTPA Acetone (Propane Furnace Additional)

Option:2

Total Fixed Capital Investment: INR 1,392 Crore



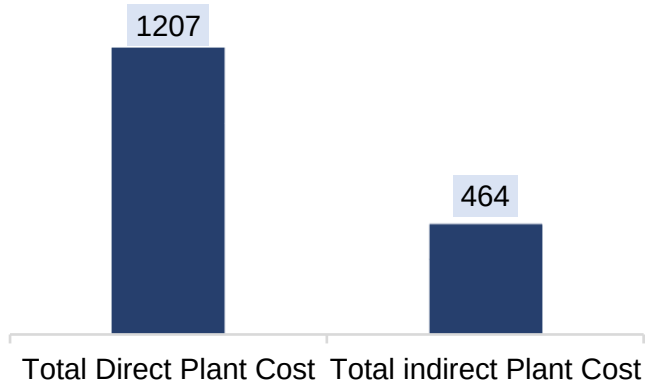
Total Capital Investment: INR 1,549 Crore



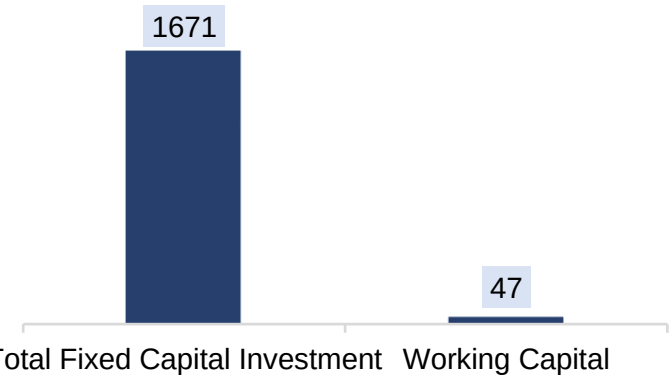
200 KTPA Phenol + 120 KTPA Acetone, (with available propylene and benzene)

Option:3

Total Fixed Capital Investment: INR 1,671 Crore



Total Capital Investment: INR 1,937 Crore



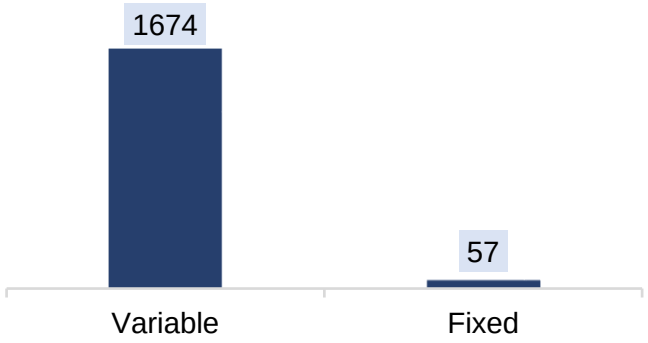
200 KTPA Phenol + 120 KTPA Acetone, (Propylene : 80 % In-house+ 20 % external)

Phenol

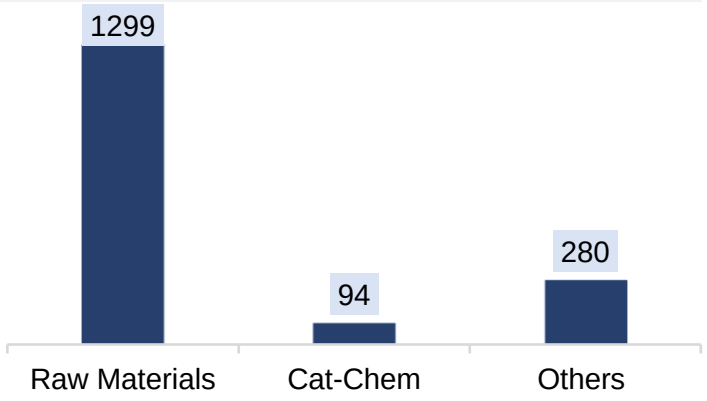
Plant Set-up: Opex

Option:1

Total Production Cost : INR 1,731 Crore



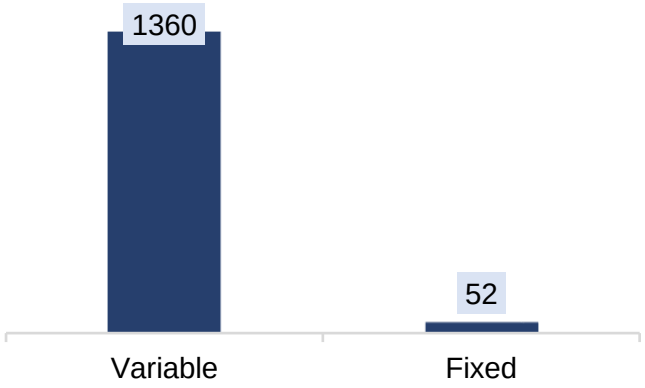
Total Variable Cost: INR 1,674 Crore



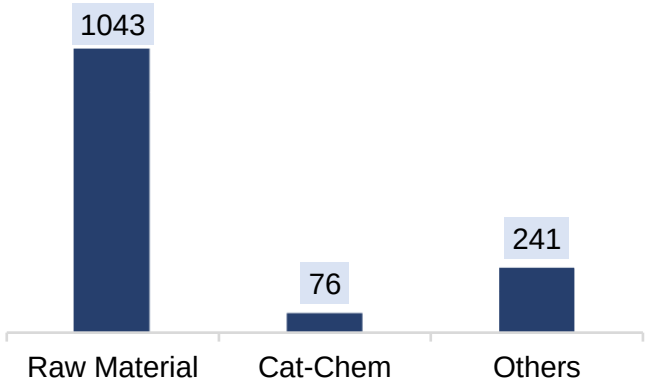
200 KTPA Phenol+120 KTPA Acetone (Propane Furnace Additional)

Option:2

Total Production Cost : INR 1,412 Crore



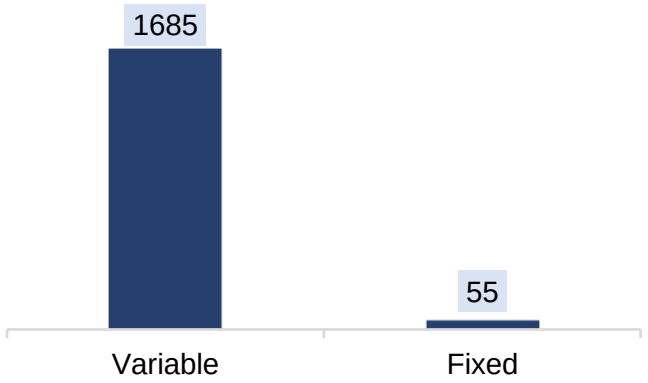
Total Variable Cost: INR 1,360 Crore



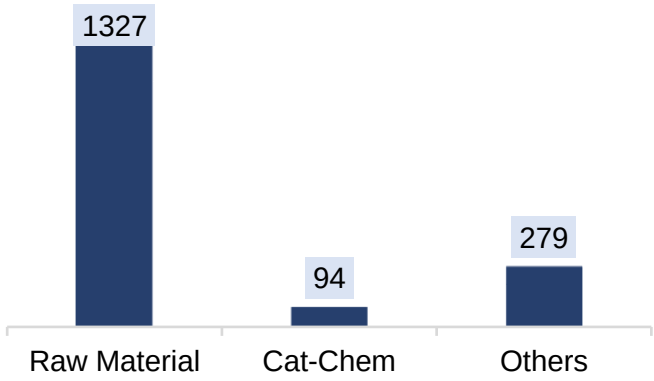
200 KTPA Phenol + 120 KTPA Acetone, (with available propylene and benzene)

Option:3

Total Production Cost : INR 1,718 Crore



Total Variable Cost: INR 1,685 Crore



200 KTPA Phenol + 120 KTPA Acetone, (Propylene : 80 % In-house+ 20 % external)

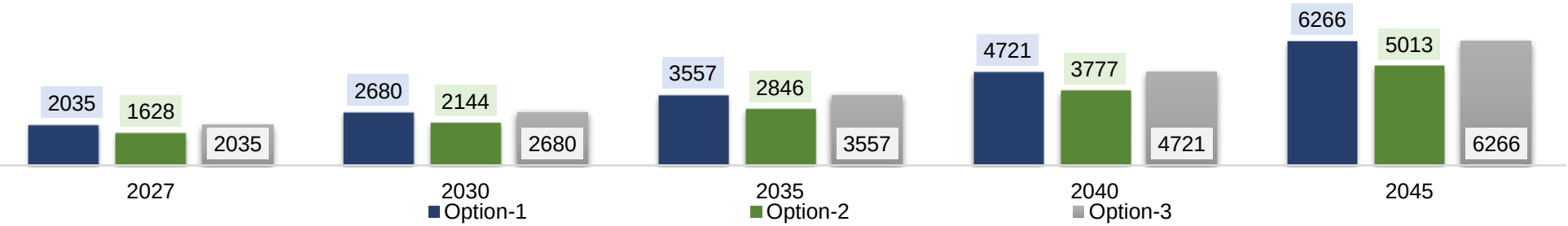
Others include Variable and Selling Overheads

Phenol

Plant Set-up: Operating Revenue, Operating Cost, Gross Margin

Operating Revenue

Note: All figures are in INR Crores

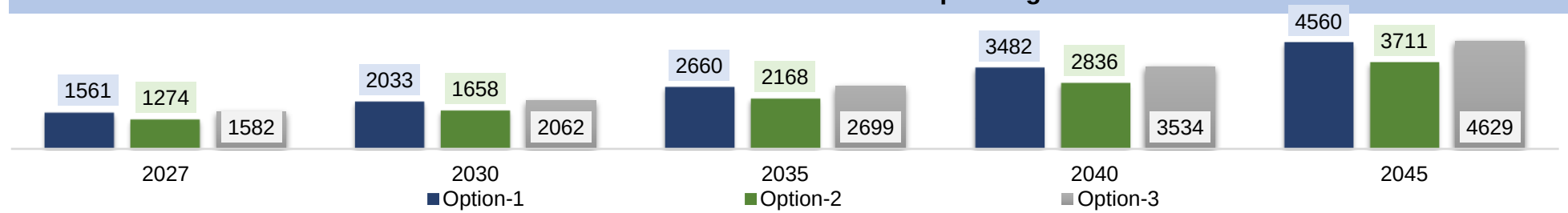


Option 1 & 3: Same operating revenue because of the production of same quantity of phenol and acetone.

Option 2 : Lower operating revenue because of 20% lesser production

Operating Cost

Note: All figures are in INR Crores

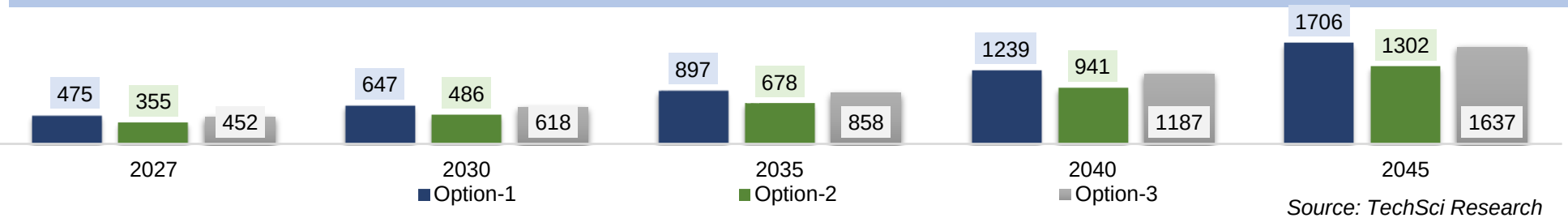


Option 2 : Lower operating cost because of lower intermediates production.

Option 1 : Higher operating cost because of higher utilization of raw materials.

Gross Margin

Note: All figures are in INR Crores



Option 3 : Gross margin higher due to lower fixed and variable cost as it require 20 percent external sourcing of propylene (refinery and chemical grade).

Source: TechSci Research

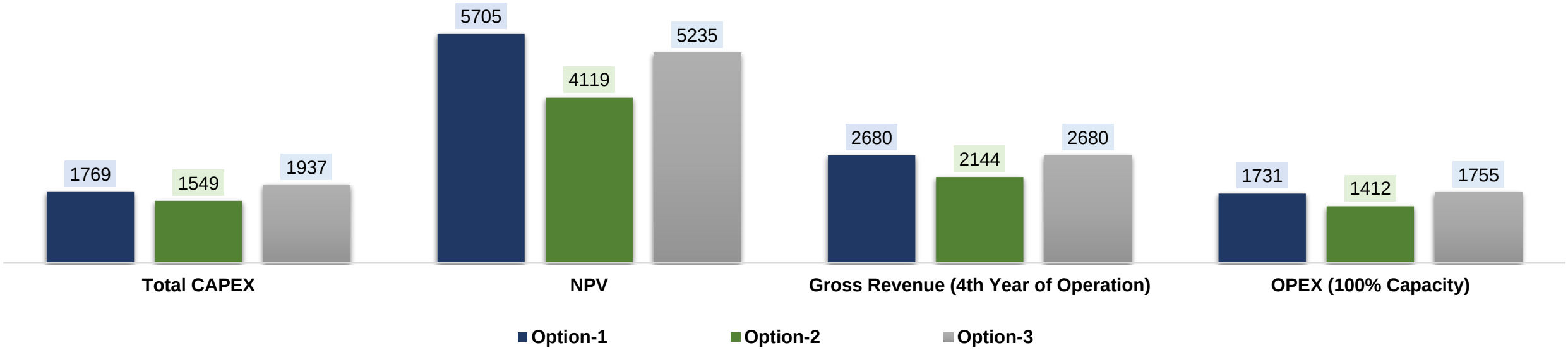
200 KTPA Phenol+120 KTPA Acetone (Propane Furnace Additional)

200 KTPA Phenol + 120 KTPA Acetone, (Propylene : 80 % In-house+ 20 % external)

200 KTPA Phenol + 120 KTPA Acetone, (with available propylene and benzene)

Phenol

Plant Set-up: Summary



All values are in INR Crores

Project Sensitivity Analysis

S.No.	Project Sensitivity	Profit After Tax Option-1
	Profit After Tax (at optimum capacity utilization)	Nil
1	Selling Price decreases by 11%, Raw Material Price remains same	63% decrease
2	Increase in Raw Material price by 16.5 % with no change in selling price	58% decrease
3	Increase in raw material price by 9 % with decrease in selling price by 5%	60% decrease
4	Increase in Cost of Production by 14.5% with no change in selling price	63% decrease

200 KTPA Phenol+120 KTPA Acetone (Propane Furnace Additional)

200 KTPA Phenol + 120 KTPA Acetone, (Propylene : 80 % In-house+ 20 % external)

200 KTPA Phenol + 120 KTPA Acetone, (with available propylene and benzene)

Source: TechSci Research

Recommendations & Conclusions

Phenol

Conclusions & Recommendations: Market Opportunity

Deepak Phenolics has integrated unit to produce IPA from Acetone

Deepak Phenolics and SI Group India has capacity of Cumene (captive consumption)

Phenol price is primarily dependent on the fluctuating price of Propylene, Benzene and Cumene

Overall, the Phenol market is expected to be more than approximately three times from 362 Thousand MT in 2021 to 1,136 Thousand MT in 2040

Phenol Formaldehyde Resin : 62% Demand

West India+ South India will Continue to be the largest region: 83% Demand (Phenol) . 80% Demand(Acetone)

Domestic Capacity Utilization : 88%

India is significantly (42%) imports dependent

Significant Exports Opportunity in Nearby Countries

Demand-Supply Gap (102 KT in 2022 to 862 KT in 2040) arguments the need for new player. No explanation /New plant announcement as of now

Downstream integration opportunities exist to produce chemical like Bisphenol A, Isopropyl Alcohol, Ketoxime etc.

Well Established technology and production of cumene as intermediate and Acetone as by product add to volume and additional revenues in this segment.

A substantial business opportunity exists, but there would always be a threat of new players entering the market, specifically those companies with the advantage of additional cumene capacity for captive consumption. The early entrant will influence the entry plans of possible another entrant.

Volatility in crude oil prices in the international market may result in increased costs of benzene and propylene (raw materials for Phenol).With the surplus supply of upstream products, the company can enter Phenol-based markets such as BPA, phenol-formaldehyde resins, and others & diversify its Product Portfolio..

West India is a strategic location to be tapped. Deepak Phenolics and SI Group India Ltd. already have a location advantage in the West. Indian producers are ramping up their production, and still, there is ample scope for setting up a new greenfield unit in West or South India.

Owing to the presence of various end-user industries and the marginal extent of the market penetration in the states such as Gujarat and Maharashtra, the west region dominates the Indian Acetone Market.

Conclusions & Recommendations: Most Suitable Plant Set-up Option

Features	Option 1	Option 2	Option 3
CapEx (INR Crore)	1769	1549	1937
OpEx (INR Crore)	1681	1360	1756
NPV (INR Crore)	6337	4781	5235
IRR	21.20%	19.22%	17.63%
Payback Period (Years) Simple	2.95	3.28	3.59
Propylene	Available through DFCU and Propane Furnace Addition	Up to 80% (DBN – 8500 Hrs. Operation)	External Procurement (Up to 20 Percent)
Benzene (Raw material & Feed)	Available through DFCU	Available through DFCU	Available through DFCU
Margin %(Starting from First Year of Operation	25.52%	24.66%	22.25%

200 KTPA Phenol+120 KTPA Acetone (Propane Furnace Additional)

200 KTPA Phenol + 120 KTPA Acetone, (Propylene : 80 % In-house+ 20 % external)

200 KTPA Phenol + 120 KTPA Acetone, (with available propylene and benzene)

Preference Rank:	1	2	3

OPaL will have sufficient propylene after the commissioning of the propane furnace. Therefore, Option 1 will have better NPV, IRR, Payback Period and margin despite having the highest CapEx

Scenario 1 is most feasible in terms of execution and realization as it won't require refinery and chemical-grade propylene sourcing from the international and domestic market.

Scenarios 2 & 3 have significantly lower NPV, IRR, while CapEx is marginally higher due to the addition of a gantry storage system for handling propylene.

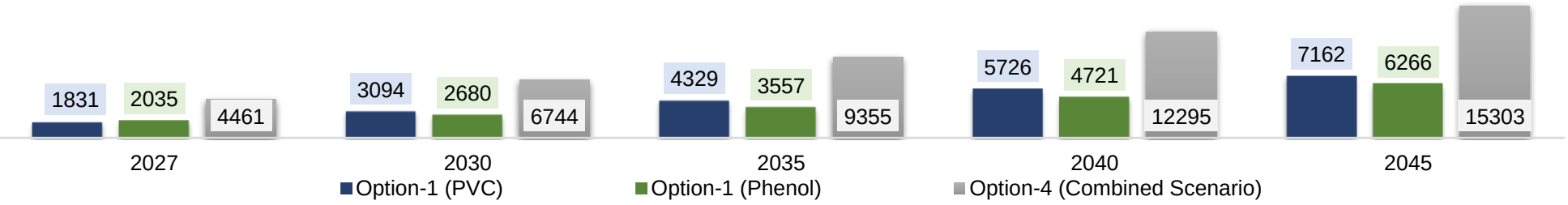

Projected sales of main products in 2013
Distribution marketing participation in the securities market.
Share of market activity
Distribution of the securities market key players
HRT
TRG
RDW
HUY
BNP
JVT
FEW
BGV
RTG

PVC + Phenol

Plant Set-up Option (PVC+Phenol)

Operating Revenue

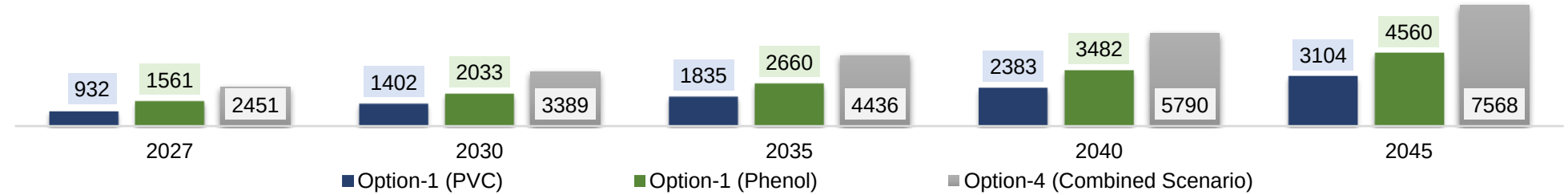
Note: All figures are in INR Crores



Option 4: : Highest due to sum of revenues of PVC, Phenol and Acetone.

Operating Cost

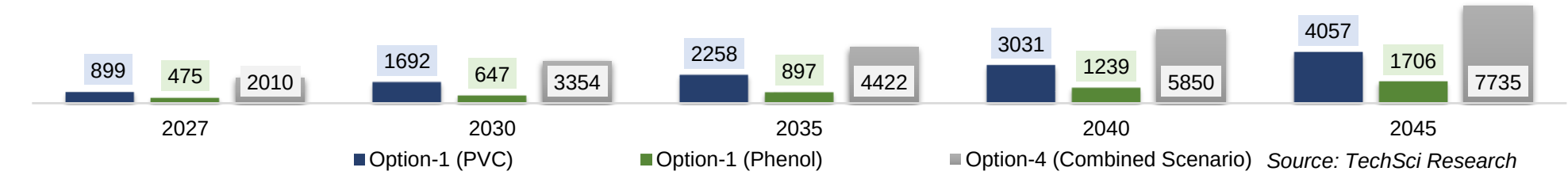
Note: All figures are in INR Crores



Option 4: : Highest because it includes the sum of raw materials of PVC and Phenol.

Gross Margin

Note: All figures are in INR Crores



Option 4: : Highest as it includes both the margins of PVC , Phenol and Acetone.

Source: TechSci Research

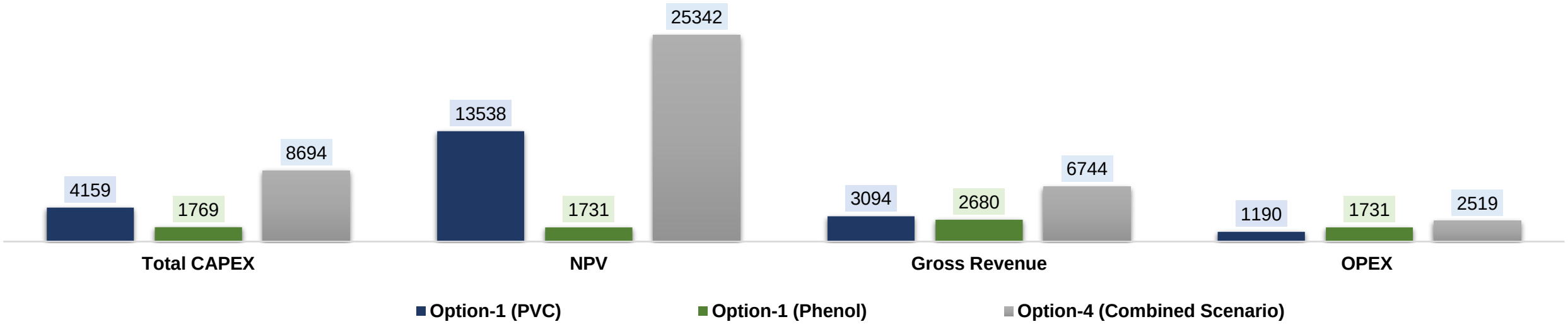
Option 1 (PVC): 350 KTPA PVC + Captive Ethylene

Option 1 (Phenol): 200 KTPA Phenol +120 KTPA Acetone (Propane Furnace Additional)

PVC + **Phenol**

Option 4: 200 KTPA Phenol + 120 KTPA Acetone and 350 KTPA PVC Resin Plant (Propane Furnace Additional)

Plant Set-up Option (PVC+Phenol)



All values are in INR Crores

Project Sensitivity Analysis

S.No.	Project Sensitivity	Profit After Tax Option-4 (Combined Scenario)
	Profit After Tax (at optimum capacity utilization)	Nil
1	Selling Price decreases by 11%, Raw Material Price remains same	31% decrease
2	Increase in Raw Material price by 16.5 % with no change in selling price	18% decrease
3	Increase in raw material price by 9 % with decrease in selling price by 5%	24% decrease
4	Increase in Cost of Production by 14.5% with no change in selling price	21% decrease

Option 1 (PVC): 350 KTPA PVC + Captive Ethylene

Option 1 (Phenol): 200 KTPA Phenol +120 KTPA Acetone (Propane Furnace Additional)

PVC + **Phenol**

Option 4: 200 KTPA Phenol + 120 KTPA Acetone and 350 KTPA PVC Resin Plant (Propane Furnace Additional)

Source: TechSci Research

Recommendations: Most Suitable Plant Set-up Option (PVC+Phenol)

Features	Option 1 (PVC)	Option 1 (Phenol)	Option 4
CapEx (INR Crore)	4159	1769	8694
OpEx (INR Crore)	1203	1681	3253
NPV (INR Crore)	13376	6337	25805
IRR	20.03%	21.20%	19.20%
Payback Period (Years) Simple	3.22	2.95	3.27
Propane (Raw material & Feed)	Propane through Parent Company ONGC	Propane through Parent Company ONGC	Propane through Parent Company ONGC
EDC/ VCM (Raw material & Feed)	Not Required	Not Required	Not Required
Benzene (Raw material & Feed)	Not Required	Available through DFCU	Available through DFCU
Chlorine Sourcing	Chlor-Alkali units (DCM Sriram, Meghmani, GACL) in proximity	Not Required	Chlor-Alkali units (DCM Sriram, Meghmani, GACL) in proximity
Jetty Facility	Not Required	Not Required	Not Required
Co-product Realization	NA	NA	Yes

Option 1 (PVC): 350 KTPA PVC + Captive Ethylene

Option 1 (Phenol): 200 KTPA Phenol +120 KTPA Acetone (Propane Furnace Additional)

Option 4: 200 KTPA Phenol + 120 KTPA Acetone and 350 KTPA PVC Resin Plant (Propane Furnace Additional)

OPaL will have sufficient ethylene, propylene and benzene after commissioning the propane furnace. Therefore, Option-4 (Combined scenario) will have better NPV, IRR, Payback Period and margin (coproduct revenue realization) despite having the highest CapEx.

Incremental ethylene and propylene availability due to other propane furnaces increase the incremental margin.

PROJECT IMPLEMENTATION SCHEDULE

Stage	Planning	Plant Set-up				Operations	
		Civil Work	Plant and Machinery	Power and Water	Others	Training and Personnel	Start -up/Commercial Production
Star-End (Month)	0-12	6-36	4-44	16-22	36-42	42	44-48
Tenure (Month)	12	30	40	6	6	1	4

PVC + **Phenol**

Annexure

Assumptions

1. Construction Period = 4 Years

2. Capacity Build Up = 1st Year: 90 % 2nd Year : 100% and 3rd Year : 100%

3. Exchange Rate = USD 1 = INR 78

4. Contingency in capex = 5 %

5. Raw material prices are 7 years historical avergae

6. Sensitivity Analysis: Impact on breakeven point due to changes in sales and operating cost.
7. Feed prices are delivered prices at refinery gate and product prices are "OPaL Net back prices"
8. Propane Furnace capex were provided by OPaL

9. The product warehouse has been sized for 30 days production of Phenol and Acetone

10.With reference to the economic summary of all the configuration is tabulated in the report.
11. Configuration with having highest IRR, NPV, Lowest opex and minimum capex are used for shortlisting
12.Exchange Rate 1 USD - INR 78

13. Feed, Propylene and Benzene prices as provided by OPaL
14. Byproduct: The weighted average price the ratio they are present in the stream
15. Cost of Capital :10%
16. Tax rate: 25%

17. Amortization is presumed to be in next 10 years on equal basis.

18. Capacity is Installed in one Phase

19. Operating Revenue is bifurcated between :-

- Accounts Receivables is taken as of 60 Days.

- Accounts Payables is taken as of 60 Days.

- Inventory is taken as of 30 Days.

20. Raw water existing GIDC rate is 43.51/M3 (escalated @ 6% every year)

Ethane	P = 1.043*(A*r+ B*s) + C, (INR/ MMBTU)
Propane	P= 1.0459*FOB Saudi Arabia CP (US$/MT)
Butane	P= 1.0459*FOB Saudi Arabia CP (US$/MT)
Naphtha ARN	P=1.011* MOPAG naphtha+.02 $ Transportation (US$/MT)
Naphtha LAN	P=1.011* MOPAG naphtha+17 $ Transportation (US$/MT)

21. Utilities: Based on major utility consumptions calculated on the basis as described under the Investment basis.

Abbreviations

CAGR	Compound Annual Growth Rate
KTPA	Kilo Tonnes Per Annum
MT	Metric Tonnes
MMT	Million Metric Tonnes
MMTPA	Million Metric Tonnes Per Annum
USD	United States Dollar
INR	Indian National Rupee
NPV	Net Present Value
IRR	Internal Rate of Return
Capex	Capital Expenditure
Opex	Operating Expenditure
PAT	Profit After Tax
ISBL	Inside Battery Limit
OSBL	Outside Battery Limit
EDC	Ethylene Di-Chloride
VCM	Vinyl Chloride Monomer

Disclaimer :

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CONTACT US

TechSci Research – North America
2950, Boundary Road, Burnaby,
British Columbia, Canada
Tel: +1- 646- 360-1656
E: sales@techsciresearch.com

TechSci Research – Europe
54, Oldbrook, Bretton,
Peterborough,
United Kingdom
E: sales@techsciresearch.com

TechSci Research – Asia-Pacific
B-44, Sector -57, Noida, National
Capital Region, UP, India
Tel: +91-120-4523900
E: sales@techsciresearch.com

TechSci Research
Cyber City, Building No. 8C, Gurgaon,
National Capital Region, Haryana,
India
Tel: +91-124-6428661
E: sales@techsciresearch.com

www.techsciresearch.com

INDUSTRY ASSOCIATIONS