

M&A Pitch Book for Woongjin Chem. & LG Chem.

Fenero IRON
[Infinite Renovation Of Nova]

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About Material....

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Executive Summary



About Woongjin Chemical and M&A

Woongjin Chemical has unique technologies about membrane (RO filter). Also, only few companies are producing RO filter in Korea and in the world. Therefore, the market is oligopoly. In this situation, if LG Chem perform M&A with Woongjin Chemical, the profitability will increase by using the capital of LG Chem to RO filter. Valuation will be proceeded by using DCF.

The strongest business part of Woongjin Chemical is filter membrane

About WC

- Woongjin Chemical has four major business departments; Polyester Fiber, Textile, Filter and Optical Materials
- Woongjin Chemical has demonstrated improving financial performance in recent years especially in filter business department : Sales grows averagely 7.5% and operating income jumped 45.4% over recent 5 years
- Woongjin Chemical has maintained its leading position as one of the largest polyester fiber production company in Korea since 1972.
- Woongjin Chemical has run filter business starting with RO filter production and sales in 1994 and .
- Woongjin Chemical divided textile department by physical split-off method in December 2012

Current Status

Polyester Fiber Industry

- Polyester Fiber industry has continued a positive session since 2009 by a steady increase in demand in developing countries
- Price is key competitiveness in general PF and PSF production whereas there is an enter barrier in super fiber production which requires high level of technology

Textile Industry

- China enlarges global M/S sharply by price competitiveness with cheap labors, so profitability of other countries are smaller

Optical Materials Industry

- This industry has close relationship with front industries such as table PC, smartphone, notebook, and PMP, and these industries are growing persistent. By tracing this, optical materials industry are also growing

Water Industry

- Paradigm in water industry has converted from chemical and physical methods to membrane filter on account of improvement in price inefficient of membrane filter

The EV is estimated by DCF, and added management right premium 10%

Estimated Acquisition Price

- EV is calculated by DCF model, and the value is KRW
- Discount rate(WACC) 7 is calculated by CAPM and permanent growth rate is 3%.
- Acquisition rate is 56.21%
- Management right premium is 10%
- Consequently, total acquisition price is about KRW

Logic of Estimation

- Sales
 - Fiber: Estimated by idle production capacity, future product market growth rate
 - Filter: Growth of RO for home use is estimated by internal growth rate
 - Growth of RO for industry use is estimated by global market growth rate(With synergy : internal growth rate)
 - Growth of MF is estimated by global market growth rate(With synergy : internal growth rate)
 - Textiles: Growth of domestic division is estimated domestic textile consumption growth rate
 - Growth of foreign division is estimated Indonesia textile exports growth rate
 - Optical Materials: Estimate by average of recent GDP growth rate
- COGS: Estimated by average proportion of expected sales amount
- SG&A: Estimated by geometric mean and expected sales
- NWC: Estimated by average receivable turnover, inventory turnover and payout turnover periods
- CAPEX: Estimated by geometric mean of each account except unusual construction and investment

Source: Industry Data, SG Fenero Research

Filter part of Woongjin Chemical, and petrochemical part of LG Chem is the core part of M&A

Why LG Chem with Woongjin Chemical

- LG Chemical has been producing petrochemicals and has idle production capacity in EG and Polyamid which are major raw materials needed producing polyester fiber and RO filters.
- LG group has carried forward a 'Project Green 2020' through which LG group is planning to invest 500 million KRW in water treatment, sun-light, EV and LED business.
- Woongjin chemical can reduce expense related raw material

Stakeholders

Equity

- Woongjin Holdings Co. holds 46.3% of equity stake in Woongjin Chemical
- Yoon's family holds 18.75% of equity stake in Woongjin Chemical

Debt

- Gyeongnam Bank holds 36%, NH holds 58%, the Korea Development Bank holds 22% and the Export-Import Bank of Korea holds 18% of all debt(both long-term and short-term debt) issued by Woongjin Chemical

Structure

- LG Chem acquires Woongjin Chemical through 100% of equity financing.
 - CC reserve of LG Chem surpass takeover price of Woongjin Chemical
 - LG group retains the amount of 500 billion KRW for water treatment business
 - The lowest cc of LG Chem in past 7 years surpass takeover price of Woongjin Chemical
 - Current Liability/Current Asset ratio is decreasing persistent from 2007
- Under the assumption above, value, cost, debt and equity were calculated

Source: Industry Data, SG Fenero Research

Overview of Woongjin Chemical



About Woongjin Chemical

Woongjin Chemical is 204th ranking in KOSPI(Market Capital: 535 billion). This company has 4 business areas, which are Fiber, Filter, Textiles, and industrial & optical materials. Although the sales are largest in fiber, filter business makes the biggest profit because it has unique RO filter technology.

Overview of Woongjin Chemical

Company Overview

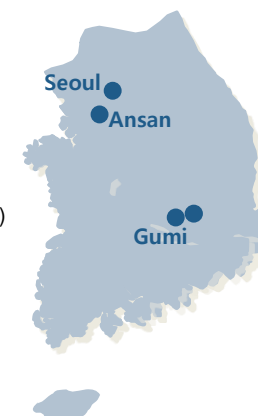
- CEO : Cheol-Goo Park
- Current Working Department
1)Fiber, 2)Textile, 3)Filter, 4)Material
- Subsidiaries : 6 Operations in 2 Countries
P.T. WOONGJIN TEXTILES(Textile) TIANJIN WOONGJIN
CSM ECOTECH (Filter Rolling) WOONGJIN CHEMICAL
SHANGHAI(International Commerce), WOONGJIN
CHEMICAL(Filter Rolling)
AMERICA INC, SUZHOU WOONGJIN (PSF) , ESLON
FIBER (Textile)
- Number of employees : 1,118



Source: Industry Data, SG Fenero Research

History

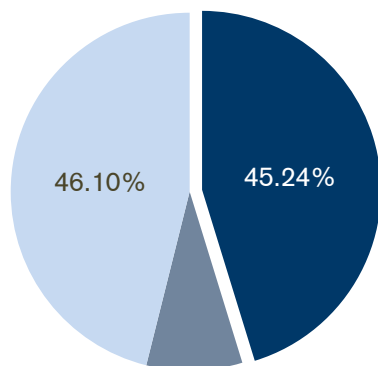
- 1972 Foundation of Jaeil synthetic fiber, Gyeongsan factory construction
- 1974. Setting up short staple, Gumi -1-factory construction for polyester
- 1994. RO(Reverse osmosis) filter production & sales
- 1997 Alteration of name to Saehan Co.
- 1997 MF filter production & Sales
- 2000 Saehan Workout
- 2003 Separation of Elite Basic from Saehan
- 2003 Separation of Saehan Platec from Saehan
- 2008 Alteration of name to Woongjin Chemical Co.(Acquisition of Woongjin Group)
- 2009 Setting up optical materials
- 2010 Launching W-RPS
- 2010 Beginning deco sheet sales
- 2011 Liquidation of W-RPS
- 2011 Beginning meta-aramid investment



Source: LG Chem, SG Fenero Research

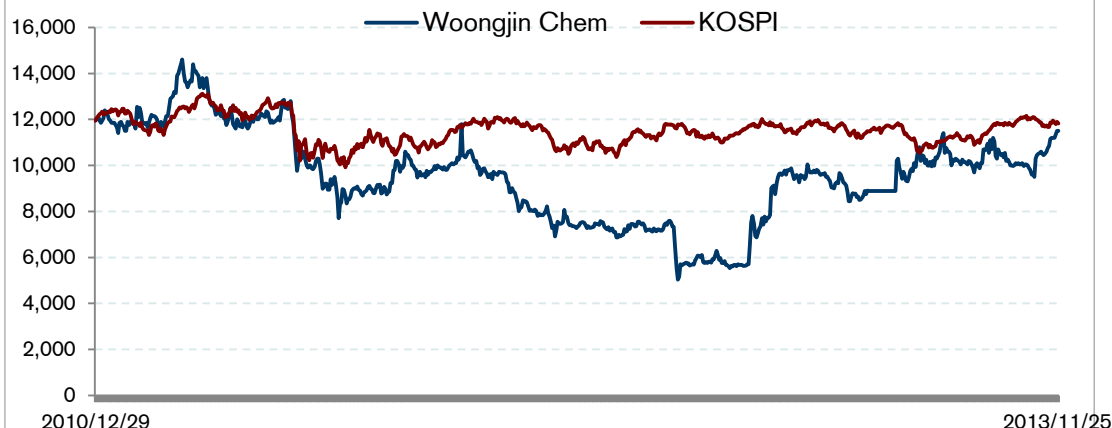
Shareholding Structure in 2013

■ woongjin coway ■ yoon-seok-geum ■ ETC



Source: Industry Data, SG Fenero Research

Stock Flow & Information



Source: LG Chem, SG Fenero Research

Network of Woongjin Chemical

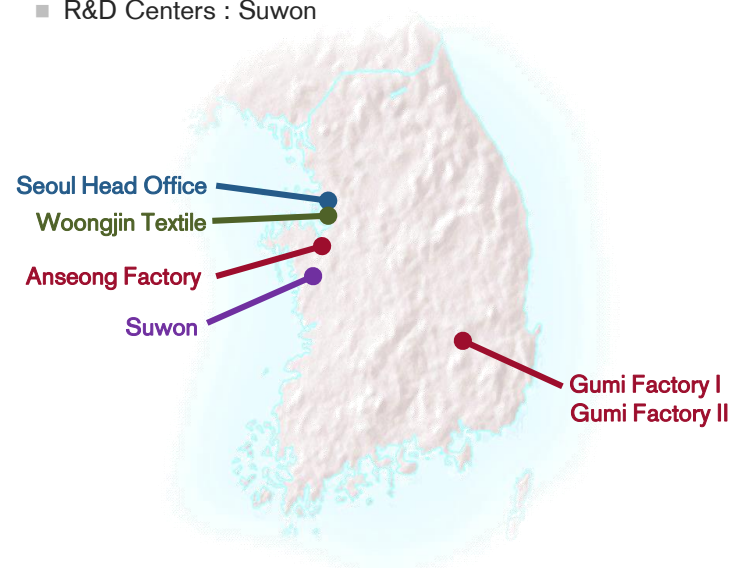
Global Network

- Overseas Marketing Subsidiaries and Branch Offices: China (Shanghai, Tianjin, Suzhou), America, Japan, India, Spain, Singapore



Local Network

- Seoul Head Office, R&D Institute,
- Domestic Plants : Gumi I, Gumi II, Anseong, Yugu
- Main Subsidiaries : Woongjin Textile Co., LTD
- R&D Centers : Suwon

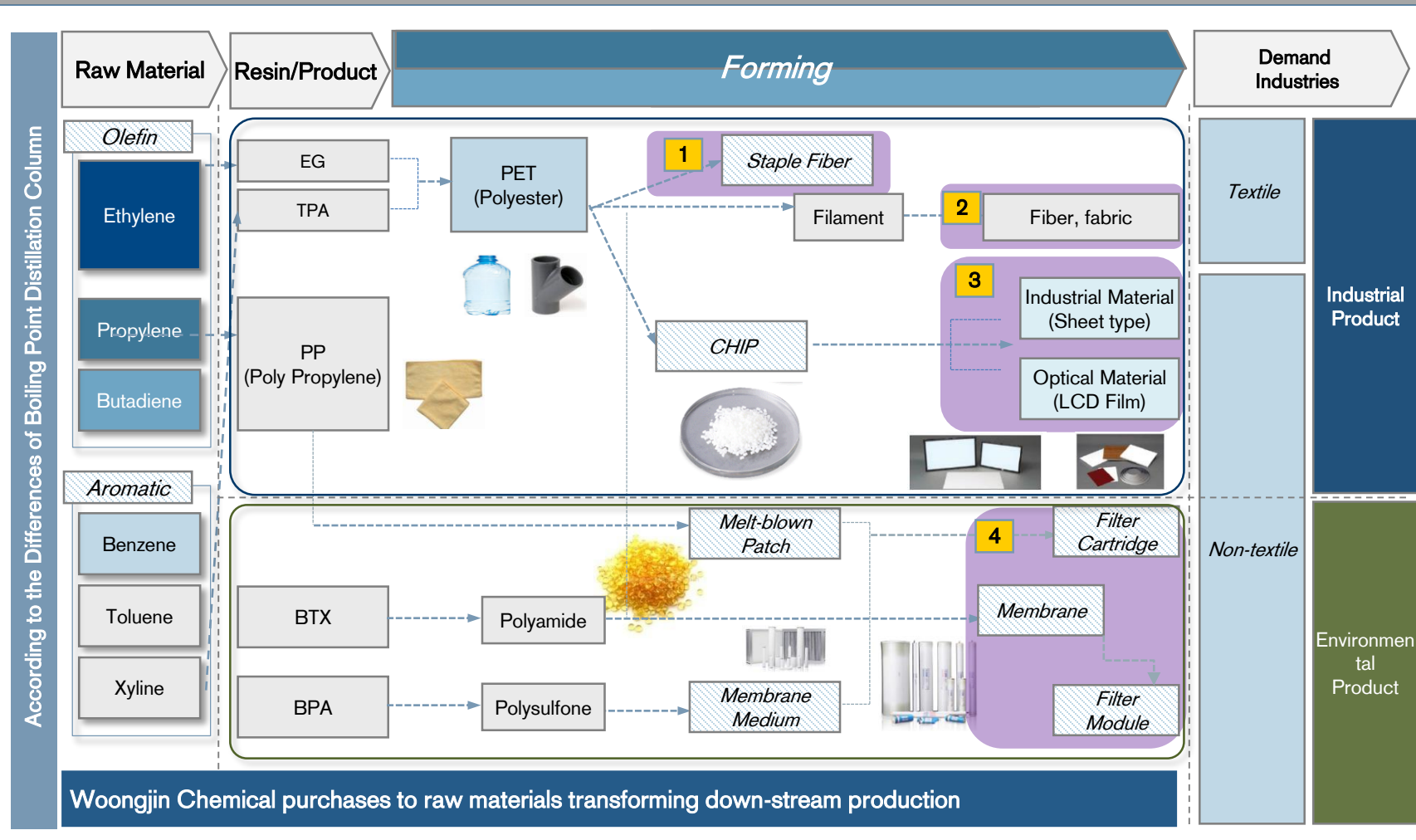


Domestic	Gumi I Factory	Gumi I Factory	Gumi II Factory	Anseong Factory
Business Department	[Fiber] PSF	[Fiber] PF	[Filter] Ro, MF etc	[Material] Sheet
Operation rate (Avg)	97.94%	77.84%	62.10%	50.19%

Source: Industry Data, SG Fenero Research

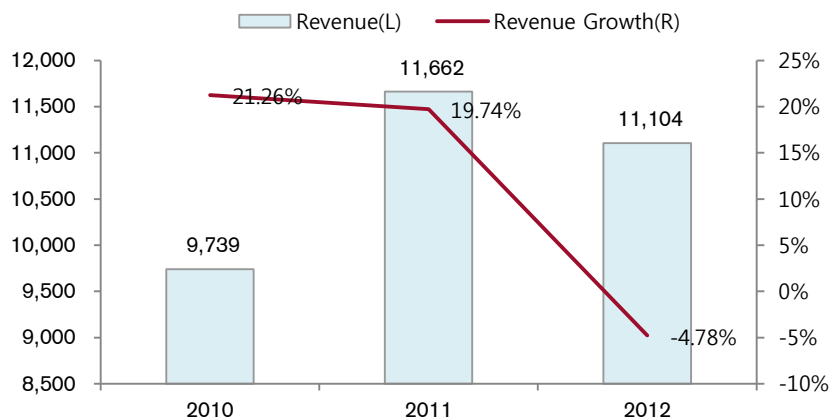
Industry is proceeded by making products with various synthesis

Macro Value chain of Woongjin Chemical



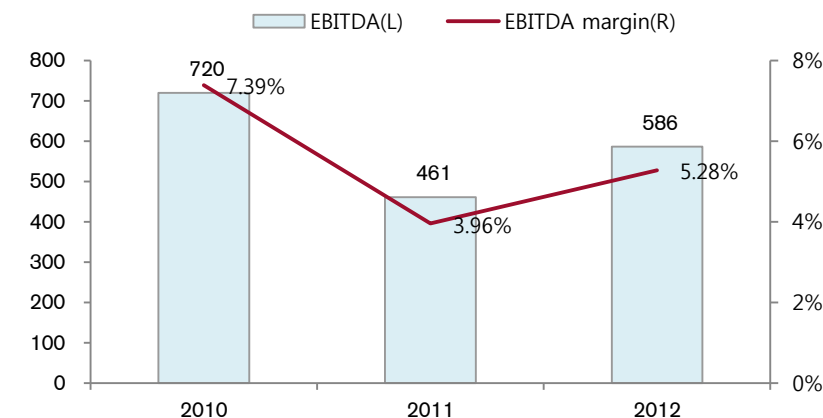
Source: SG Fenero Research

Revenue



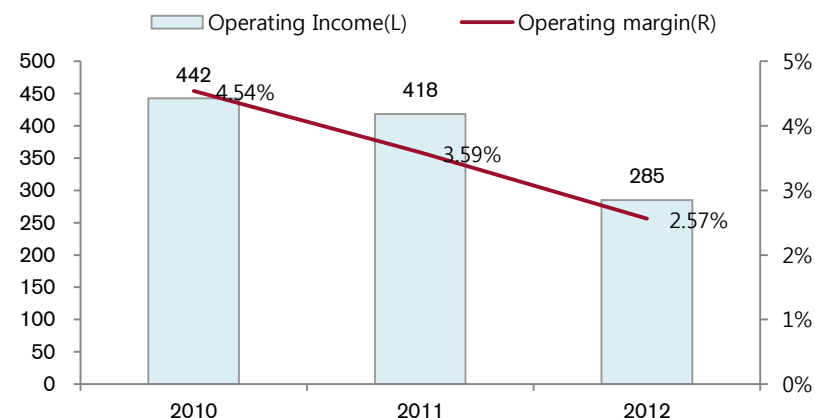
Source: DART

EBITDA



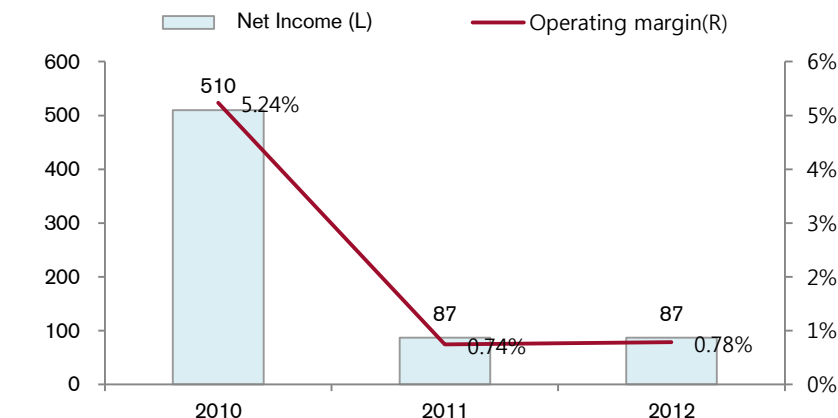
Source: DART

Operating Income



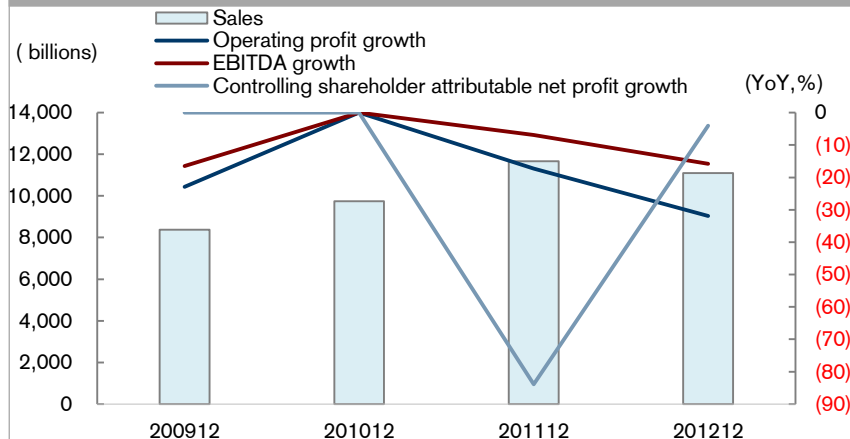
Source: DART

Net Income



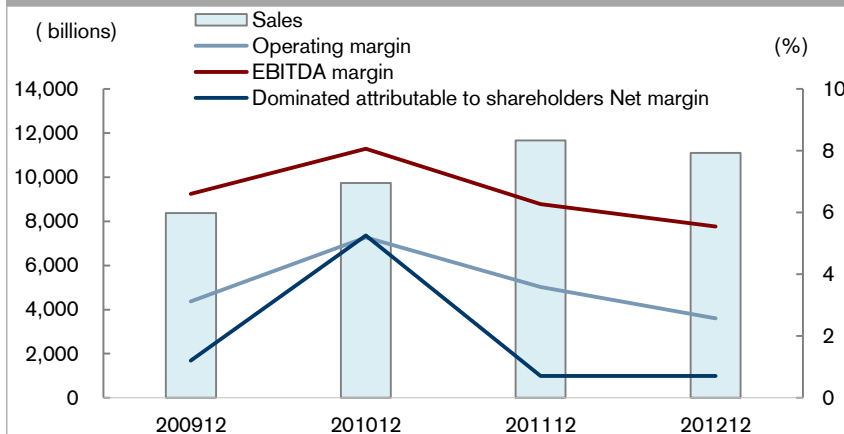
Source: DART

Earnings Growth



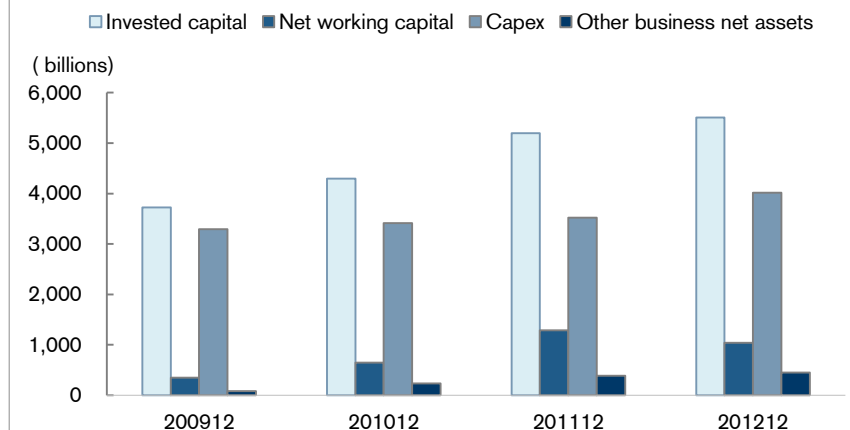
Source: DART

Earnings Margin



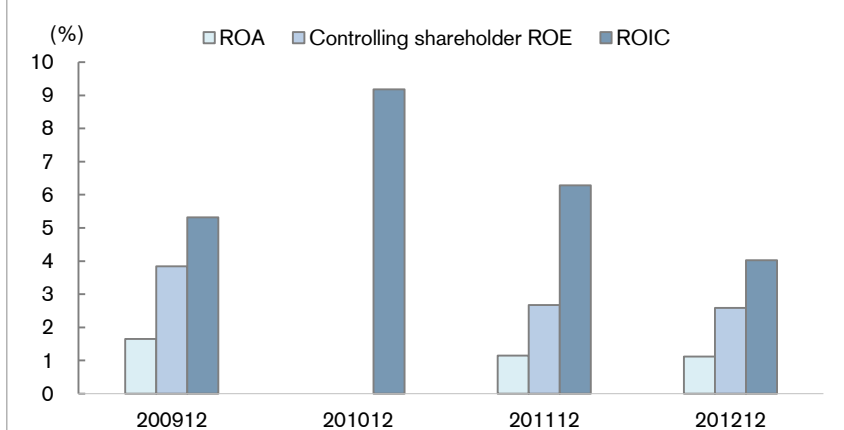
Source: DART

Invested Capital



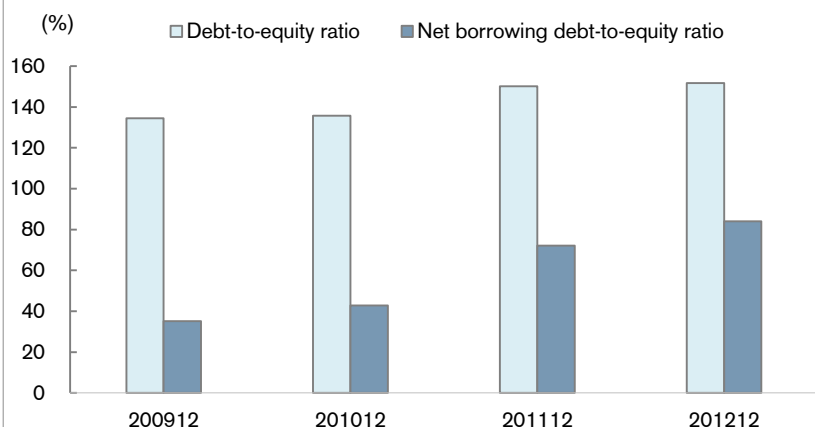
Source: DART

Return on Investment



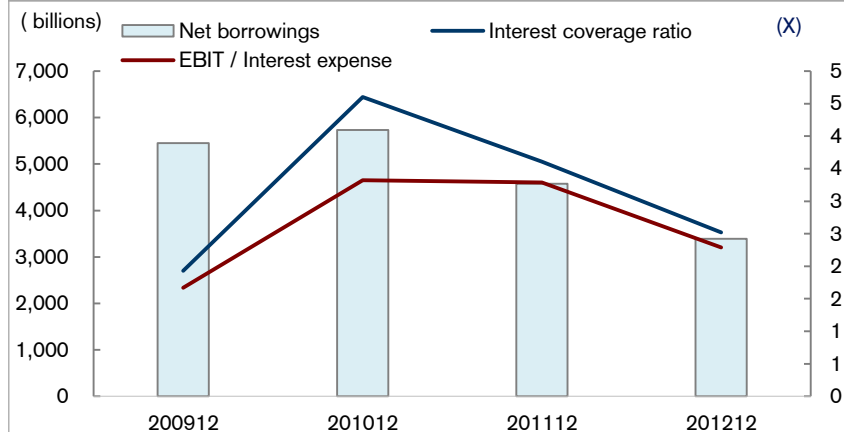
Source: DART

Debt Ratio



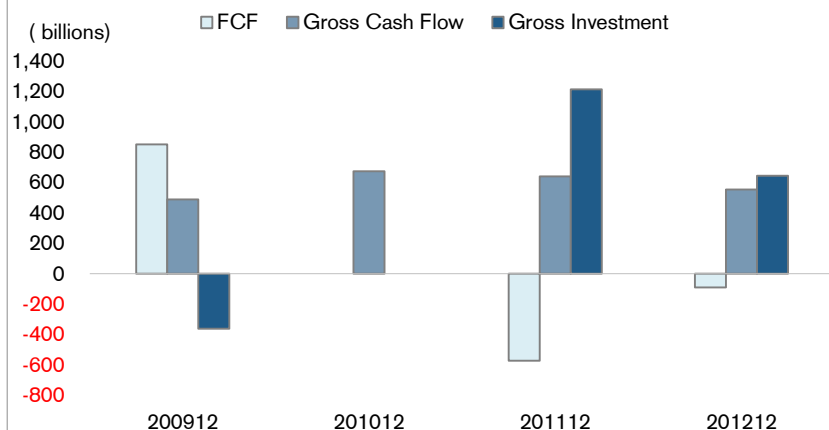
Source: DART

Interest Coverage Ratio



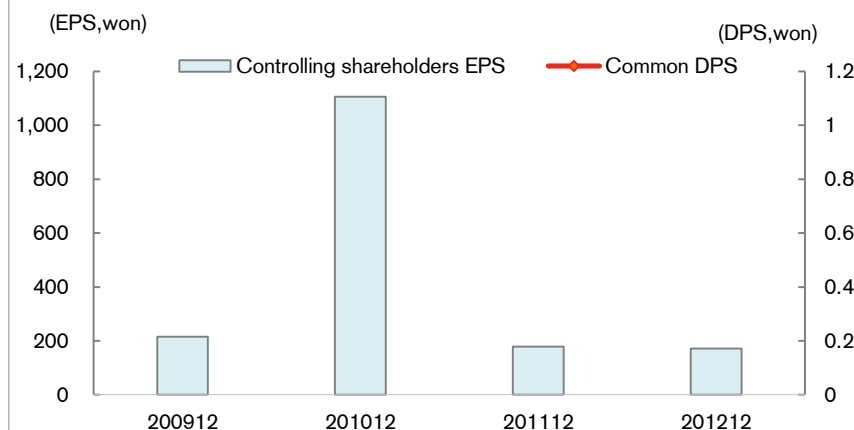
Source: DART

Free Cash Flow



Source: DART

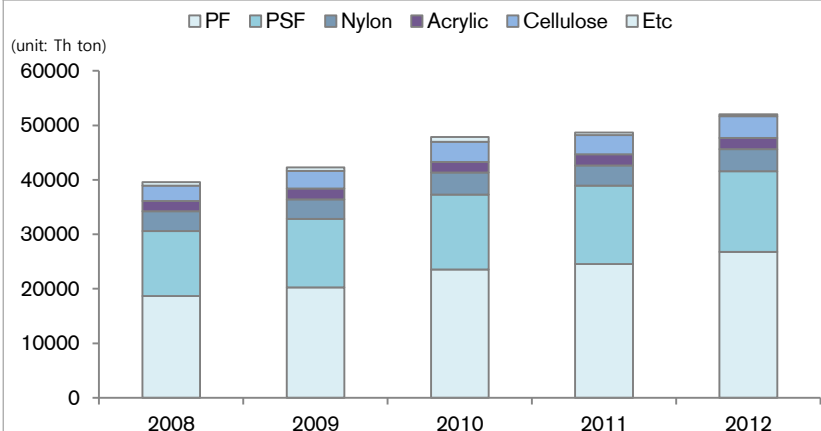
Dividend Per Share



Source: DART

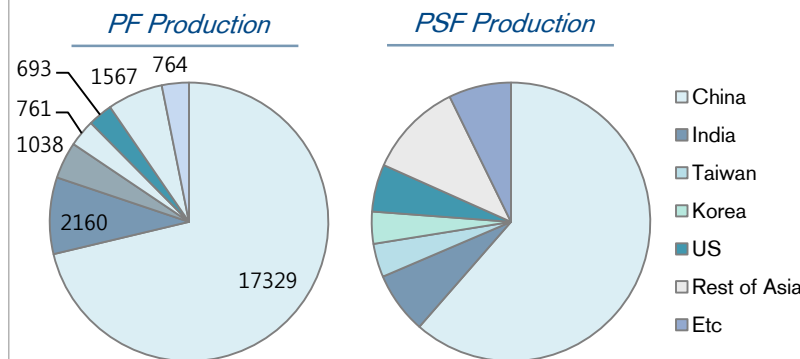
China has lead global polyester fiber industry growing.

Global Manmade Fiber Production



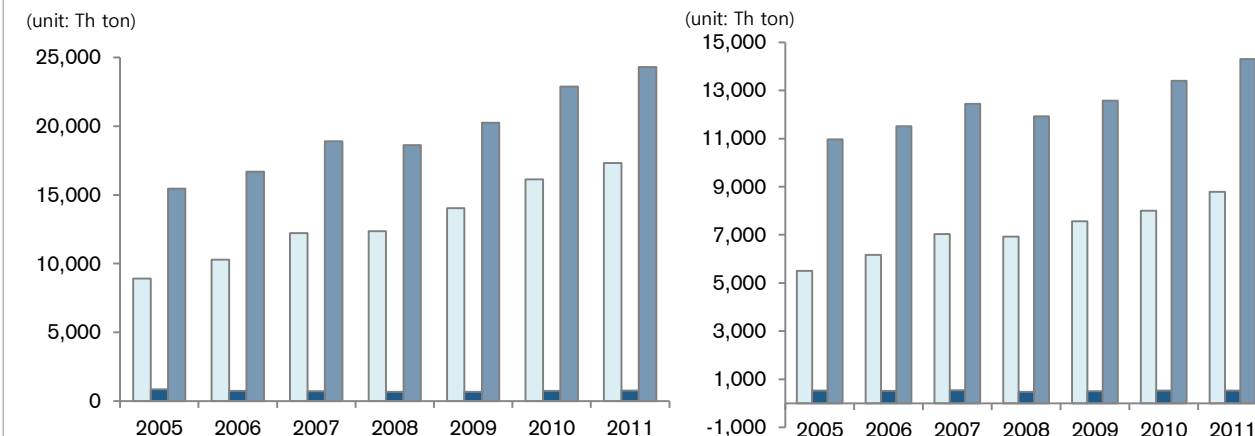
Source: KCFA

2011 PF/PSF Production by Region



Source: Fiber Organon

Global PF/PSF Production over Periods



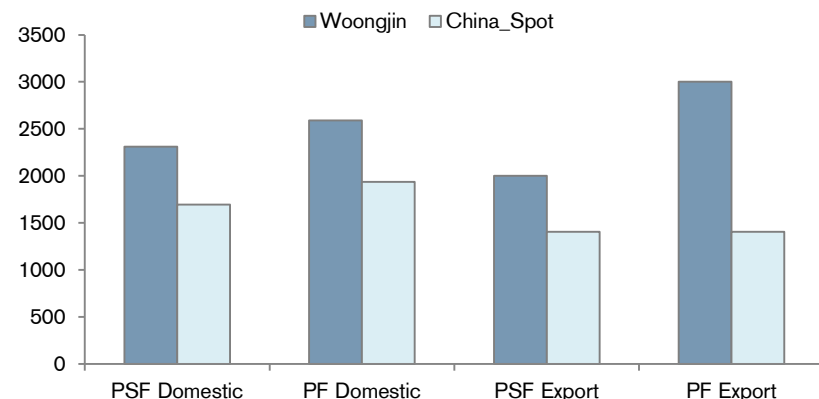
Source: KCFA

2005~2011 CAGR

	PF	PSF
Total	7.9%	4.5%
China	11.7%	8.1%
Korea	-2.1%	0.3%

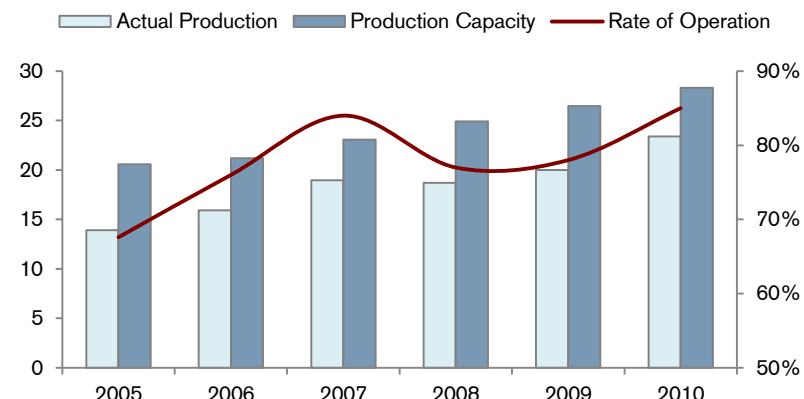
Polyester fiber industry in China still thrives in spite of anti-dumping duty.

PF/PSF Price comparison



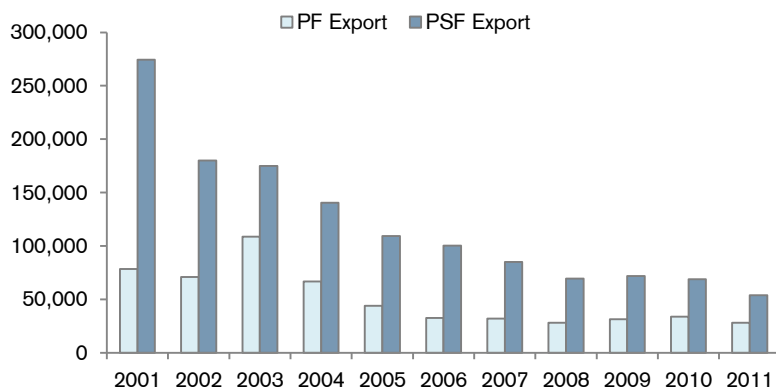
Source: KCFA, Fenero Research

Polyester Fiber Supply and Demand in China



Source: CCF

Anti-dumping duty against China and Export trend



Trial	Date	Target Countries		
		China	Taiwan	Malaysia
The Original Trial	'06.10.20 ~'09.10.19	8.69%	2.76~8.69%	2.78%
1st Retrial	'10.05.18 ~'13.05.17	3.36~8.69%	2.37~7.35%	5.59%
2nd Retrial	'13.10.29 ~'16.10.28	2.72~8.69%	2.22~7.35%	3.96~5.59%

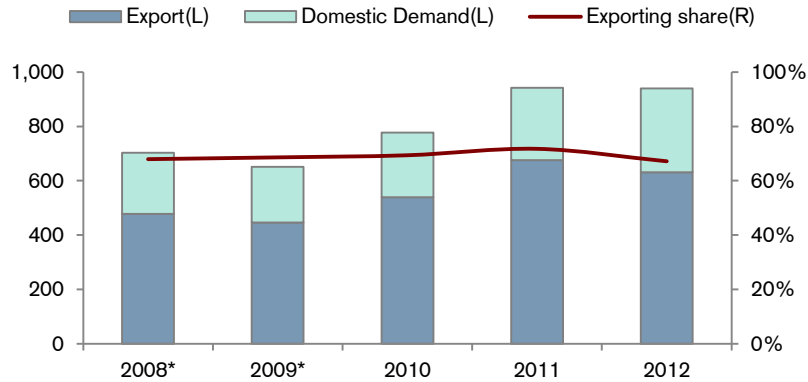
Purpose : To protect domestic polyester fiber industry from rapidly increasing Chinese production capacity

*Hengli Chem('12: 50 th-ton), Shenghong Chem ('13: 300 th-ton, '14: 450 th-ton)

Source: Fenero Research, Fiber Organon

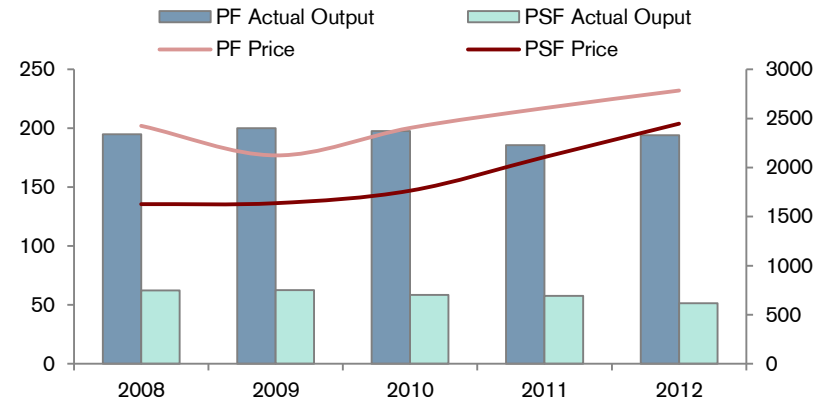
Woongjin Chem's Operating margin has been improved as raw material price stabilized.

Fiber Sales of Woongjin Chem



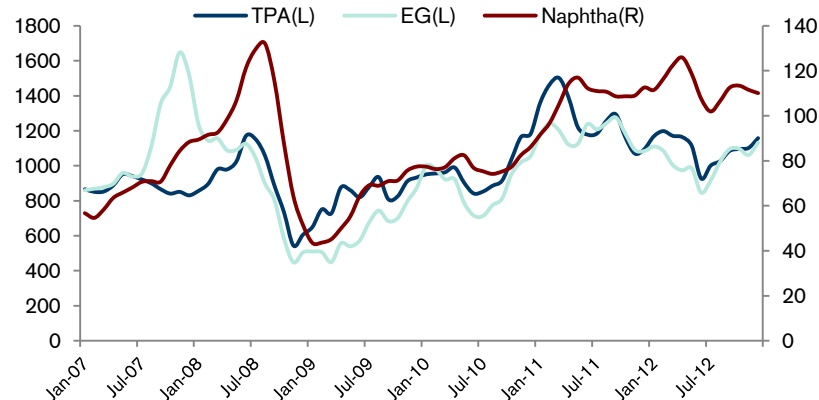
Source: DART

Woongjin Chem's Productions of PF/PSF



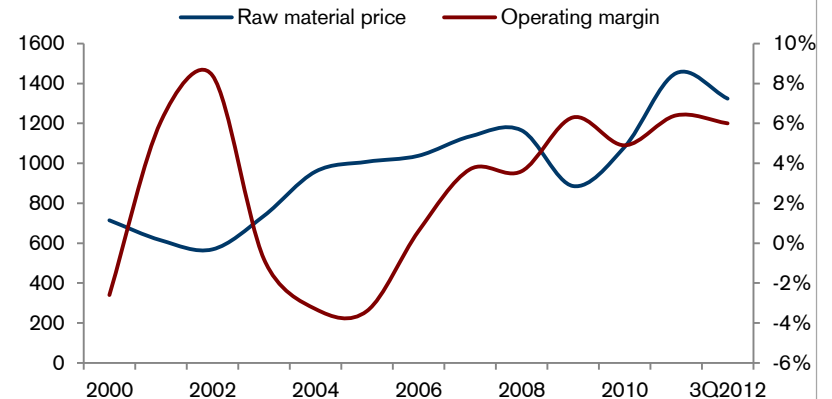
Source: DART

Price Trend of TPA/EG/Naphtha



Source: Statistics Korea

Correlation of Raw material Price and Operating Margin

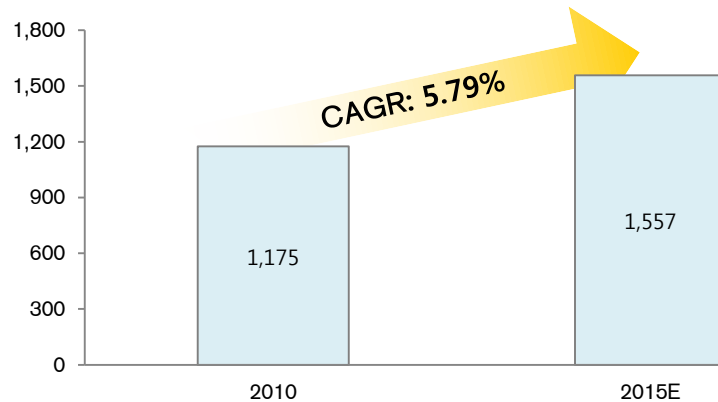


Source: DART, Company Data

After mid 2000s, China takes m/s of other countries in textile industry by using cheap labors

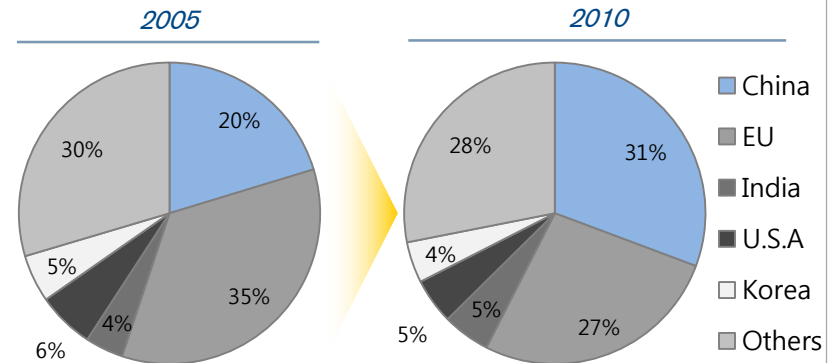
Global Textile Market Growth

Unit: Bn KRW



Source: Textiles: Global Industry Guide, Market Line

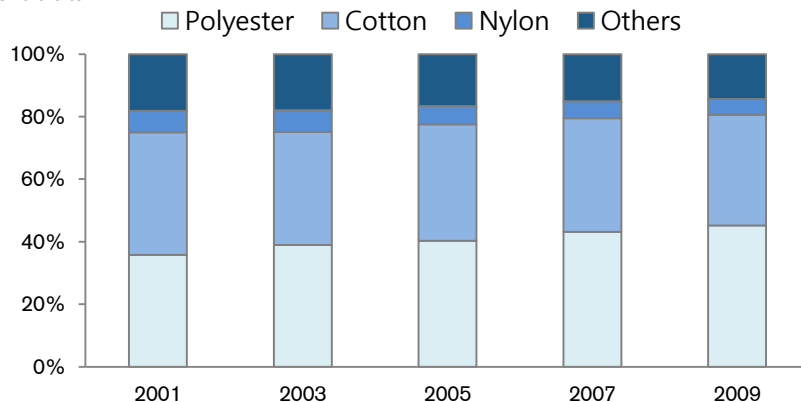
Global Textile Market Share



Source: WTO, International Trade Statistics, 2011

Ratio of Polyester Textile in global textile market

Unit: thd ton



Source: HMC Research

Relative Informations

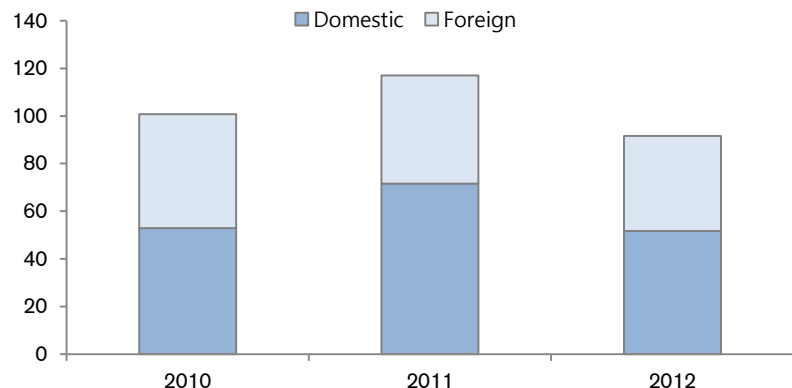
- Textile industry does not have importance in technologies or product differentiation. The most important point in textile industry is the cost. Cost of textile gives competitiveness to firms. Because Chinese firms use cheap labors, they take larger portions of textile M/S.
- The ratio of polyester becomes larger and larger. In the early 2000s, the cotton has the largest portion in textile industry. But in 2009, polyester gets the largest portion that is more than 40% of total textile market. This can be good signal to Woongjin Chemical because the firm produces textiles made up of polyester.

Source: LG Chem, Fenero Research

Woongjin Chemical survived by restructuring to raise profitability

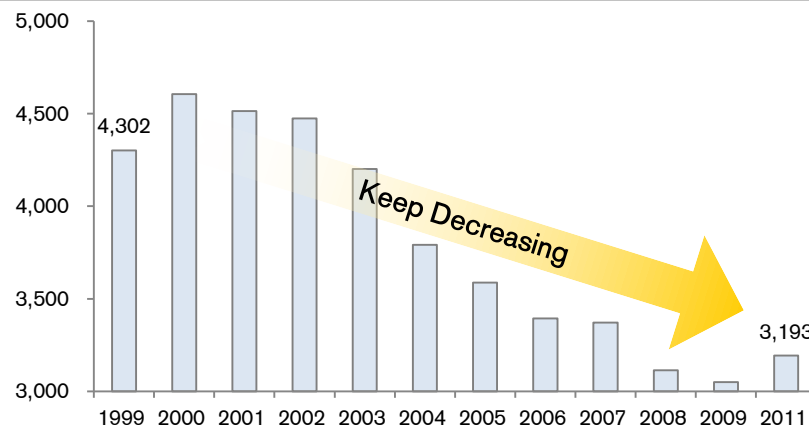
Sales of Woongjin Chemical Divided in Area

Unit: Bn KRW



Source: DART(Woongjin Chemical), Fenero Research

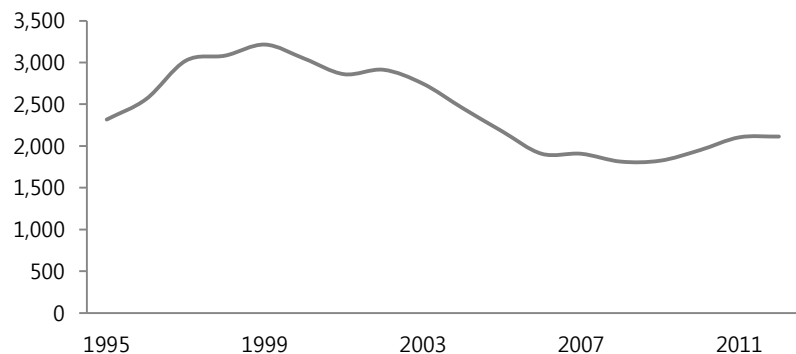
Number of Textile Companies(Except Garment) in Korea



Source: KOSIS(Korean Statistical Information Service), Fenero Research

Domestic Textile Production

Unit: thd ton



Source: Industry Data, Fenero Research

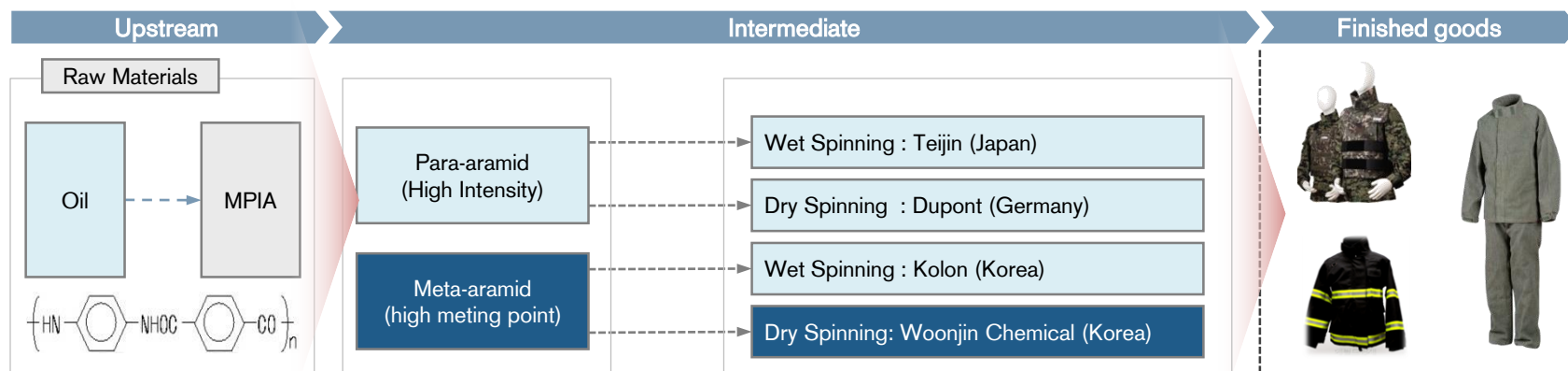
Related Information

- By high growth of Chinese firms, the firms in other countries containing Korea started to bankrupt because they can't decrease the cost of textile.
- Woongjin Chemical couldn't be the exception because the company sales textile both in Korea and exports textile to foreign countries(almost 5:5). But the firm did restructuring resolutely. Eventually, Woongjin Chemical recover its profitability. The operating income is overcoming negative amount and tracing positive amount.

Source: LG Chem, Fenero Research

Aramid can improve the profitability of Woongjin Chemical

Domestic Penetration Rate of Water Purifier



Source: Industry Data, Fenero Research

Domestic Penetration Rate of Water Purifier



Para-aramid

- 5 times more intensive than steel
- Immune in heat to 550°C
- \$60~120 per kg

Meta-aramid

- Immune in heat to 400 °C
- \$20~40 per kg (about 15 times more expensive than familiar fiber)

Source: Industry Data, Fenero Research

Domestic Market Share of Water Purifier (2012)

Wet Spinning

- Using solvent to cool down and react with the material
- Low initial investment cost
- Need of extra process
- Lower quality than Dry Spinning
- Low Spinning Speed (~100m per minute)

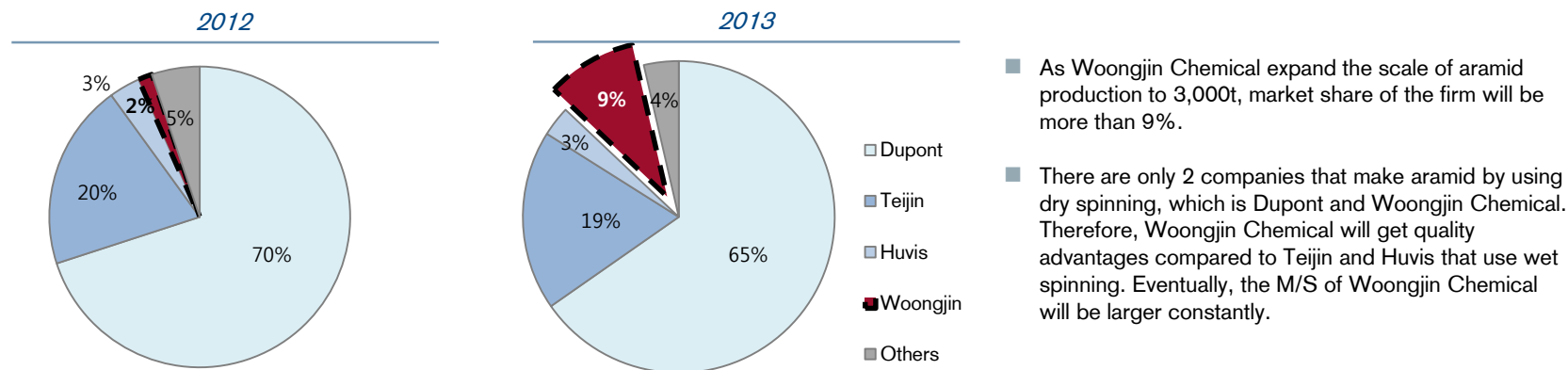
Dry Spinning

- Using gas to cool down and react with the material
- High initial investment cost
- No need of extra process
- High quality than Wet Spinning
- High Spinning Speed (300~700m per minute)

Source: LG Chem, Fenero Research

By M/S growth of Woonjin Chemical and aramid market growth, high profit is expected

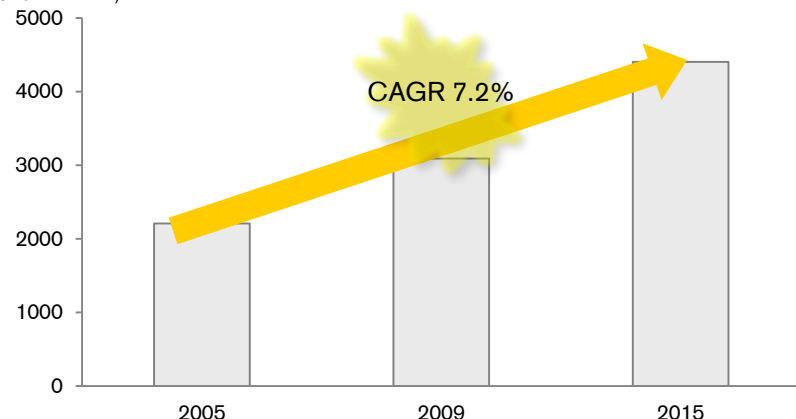
Changes of Meta-aramid Market Size (2012, 2013)



Source: Korea Federation of Textile Industries, MK Money

Meta-aramid Market Growth Rate

(Unit : Bn KRW)



Source: Korea Federation of Textile Industries, Woonjin Chemical, Fenoro Research

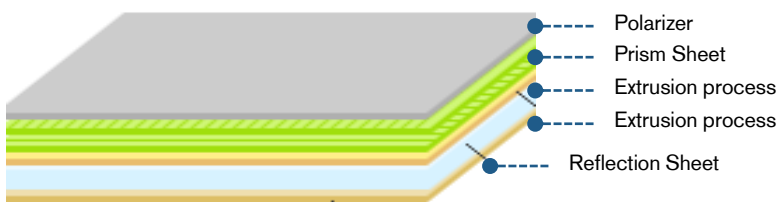
Related Information

- Price of aramid is about \$30~40 per kg. It is 15 times more than normal fiber. Also, aramid is high-value product because it creates more than 10% operating margin rate. Therefore, aramid will contribute to raise the profit of Woonjin Chemical.
- It is hard for companies to enter aramid market because the form of market is oligopoly. But once the firm enter this market, it will report high operating margin rate. Woonjin Chemical already entered this market, and aramid will be new source of profit instead of staple and filament

Due to the ongoing restructuring of the division ensute steadily being reduced.

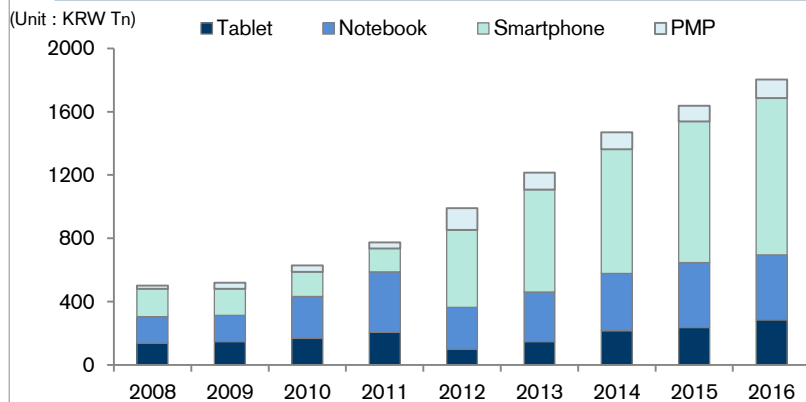
Introduction of Optical Materials

Structure Diagram of Back Light Unit (BLU)



■ BLU is the real source of light from lamp brightness to create a uniform consist of flat light. CCF.El, light guide, prism film, diffusion film.

Demand Trends of Prism Film Market

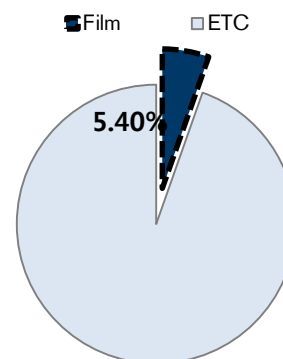


■ Prism film market is part of the display. Two parts that can be replaced, so the display panel also grow in proportion to the growth of the market.

Source: Displaybank, Fenere Research

The Issue of Current Business

Weight of Material

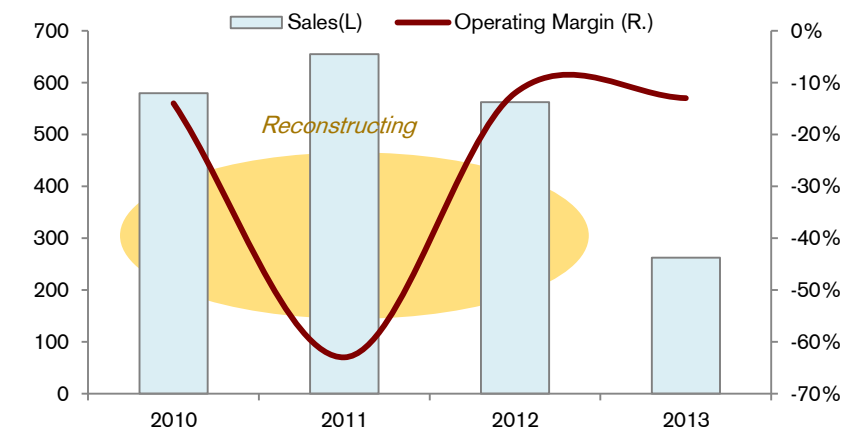


Issues

- Since, cannibalization of diffusion film and prism film is made, coupled with cost reduction policies, development of composite prism film development and production technology of the panel, taking early reflective polarizing film
- Demand expectations of reflective polarizing film based on the development of LED BLU LCD TV,
- Woongjin Chem. Dropped this Business Department

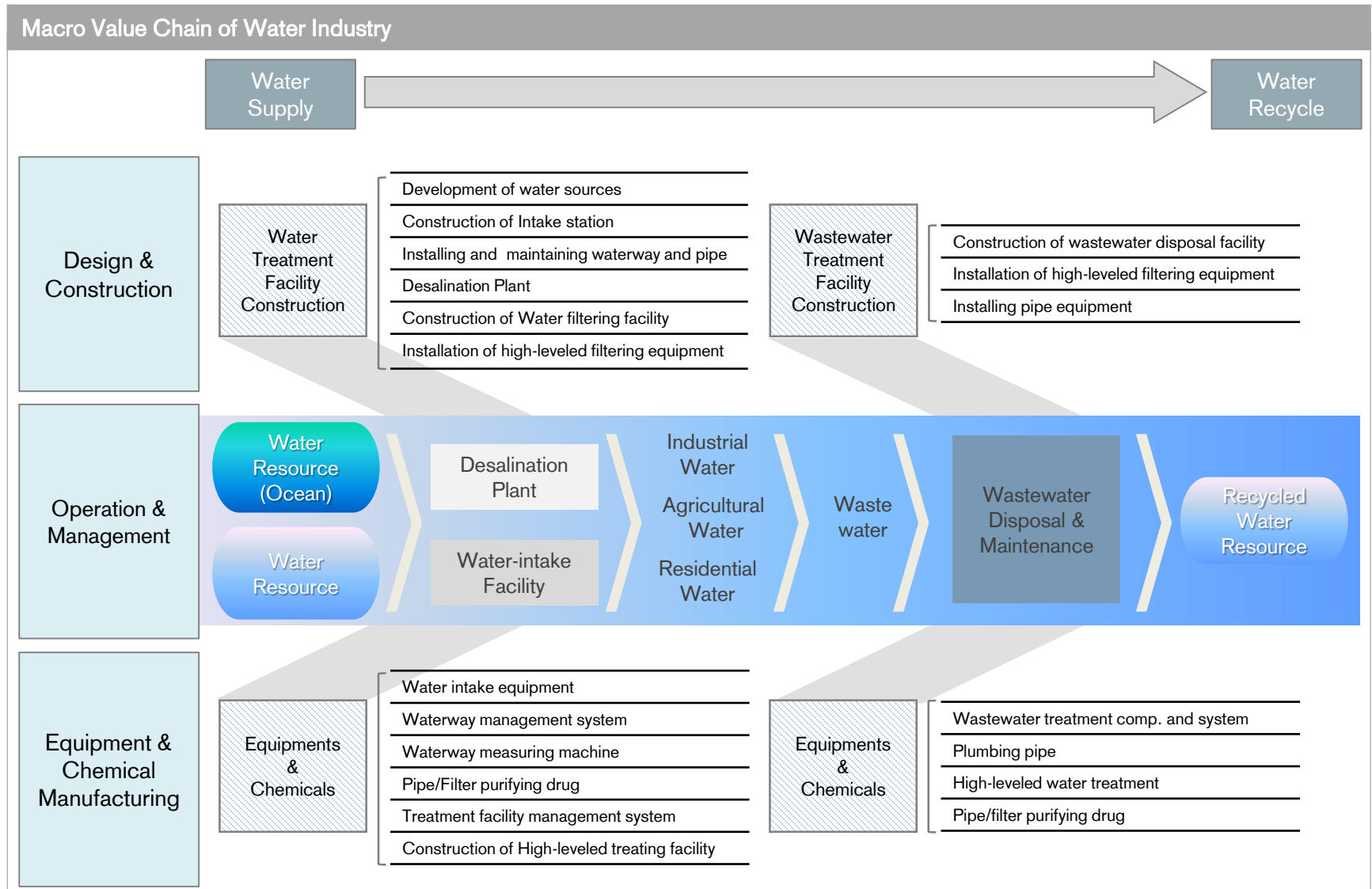
Source: Company Data, Fenere Research

Sales of Optical Materials Department



Source: Company Data, Fenere Research

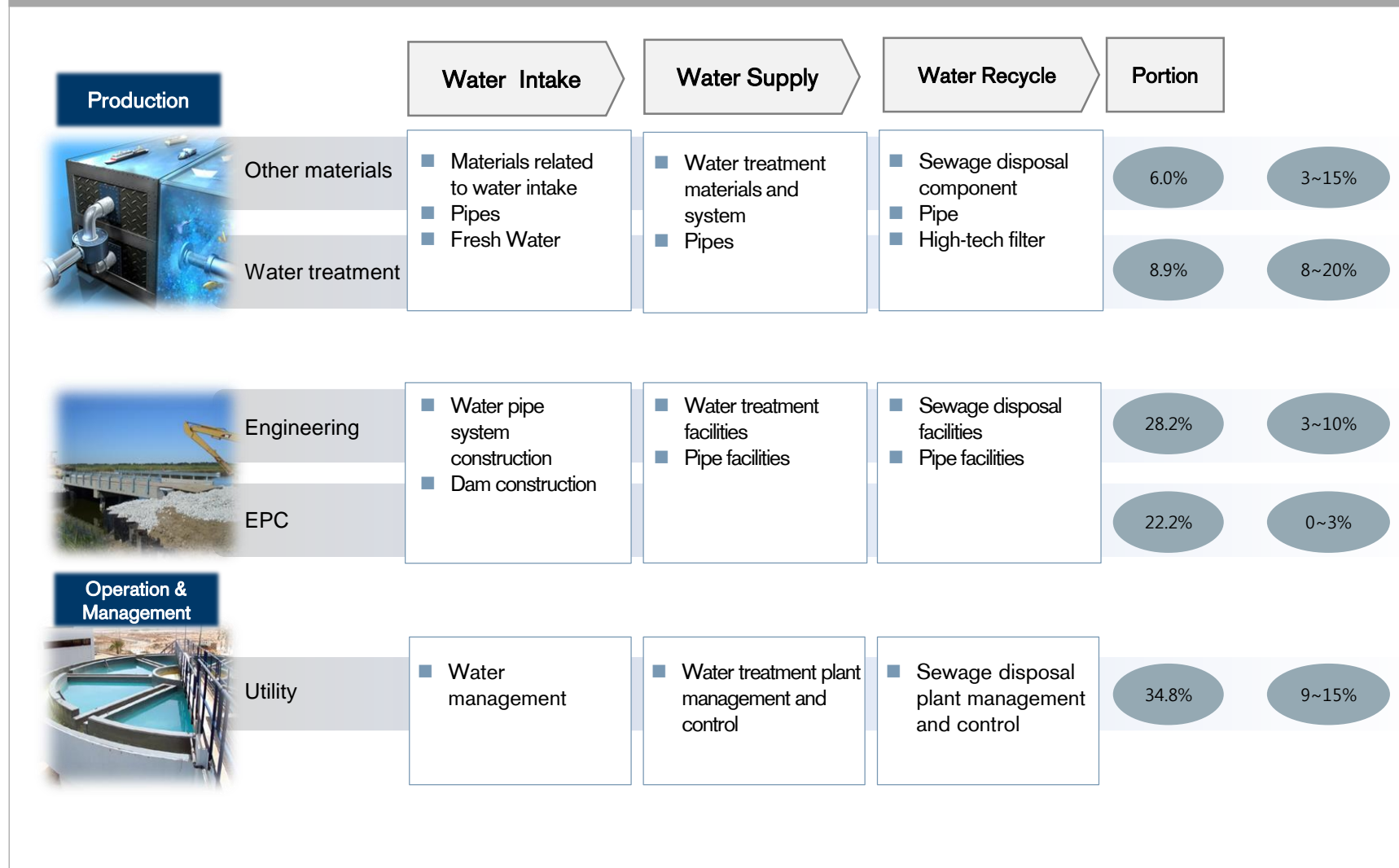
Overview of Water Industry



Source: Fenero Research

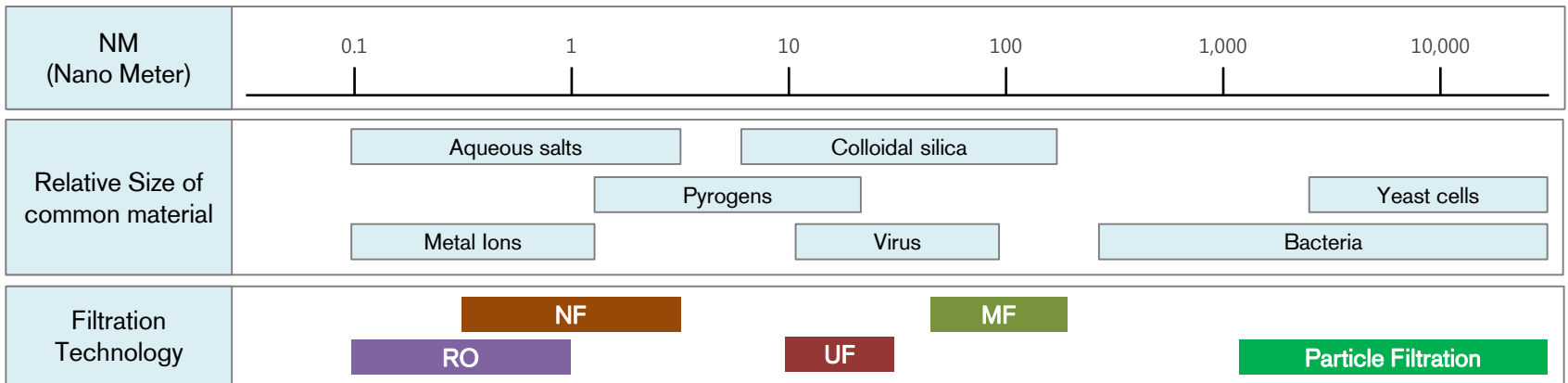
Overview of Water Industry

Micro Value Chain of Water Industry



Filter Membrane Products Classification

The Membrane Filtration Spectrum



Source: Global Water intelligence, Fenero Research

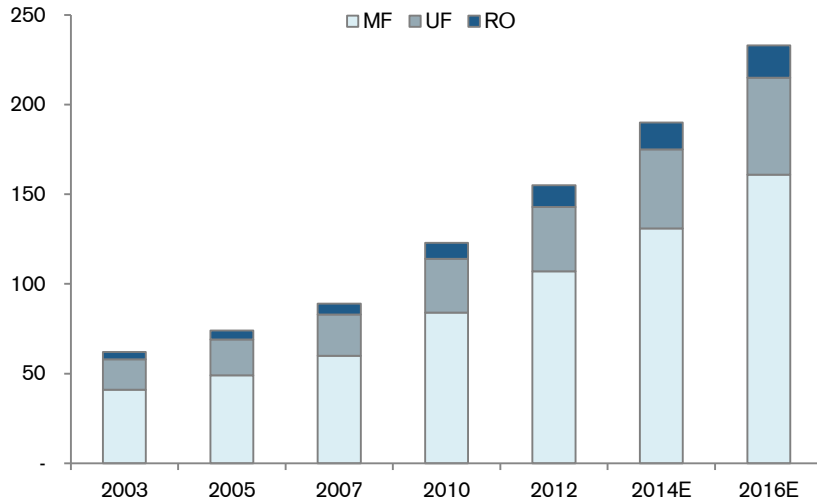
Information about 4 kinds of Filters

	RO (Reverse Osmosis)	NF (Nano filter)	UF (Ultra filter)	MF (Micro filter)
Use	Ultra-pure water, Seawater desalination, Plating wastewater	Material separation, Seawater desalination preprocessing,	Water treatment, RO preprocessing, Enrichment, Axenic water	Water purification, Industry process
Domestic Players	Woongjin Chem	Woongjin Chem	Kolon, KMS	Woongjin Chem, Synofex
Foreign Players	Dow Chem, GE, Nitto Denko, Toray	Dow Chem, Nitto Denko	GE, Simens	Pall, Millipore, Entegris, Satorius
Present Condition	Sales 79.9 Bn KRW	R&D	Quality Certification	Sales 14.1 Bn KRW Cost competitiveness

Source: Industry Data, Fenero Research

Prospect of filter membrane market is positive, but Woongjin Chemical must endeavor for gaining M/S.

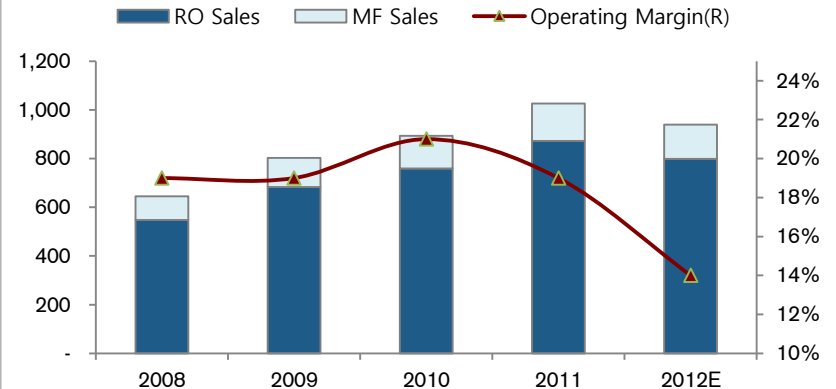
Global Membrane Market Growth Trend



	Ratio(2012)	CAGR(03-12)
RO	7.74%	12.98%
UF	23.23%	8.69%
MF	69.03%	11.25%
Total	100.00%	10.72%

Source: KITA, Fenero Research

Woongjin Chem's Trend of Filter Sector Sales



Source: KITA, Fenero Research

Worldwide Water Market Volume by Field (2010)

Category	Amount	Ratio	Avg. OPM
Equipment & Chemicals	Facilities	69.4	16.4%
	Membrane	34.7	8.2%
	Pump, Valve	22.3	5.3%
	Chemicals	27.0	6.4%
	Others	12.0	2.8%
Operation & Management		196.6	46.4%
Design & Construction		61.9	14.6%
Sum		439.9	100%

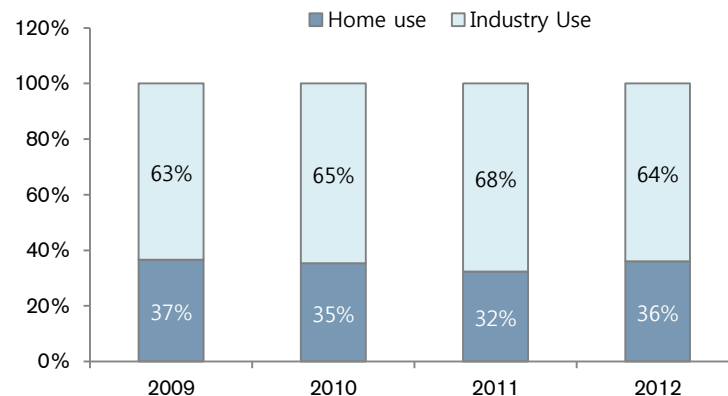
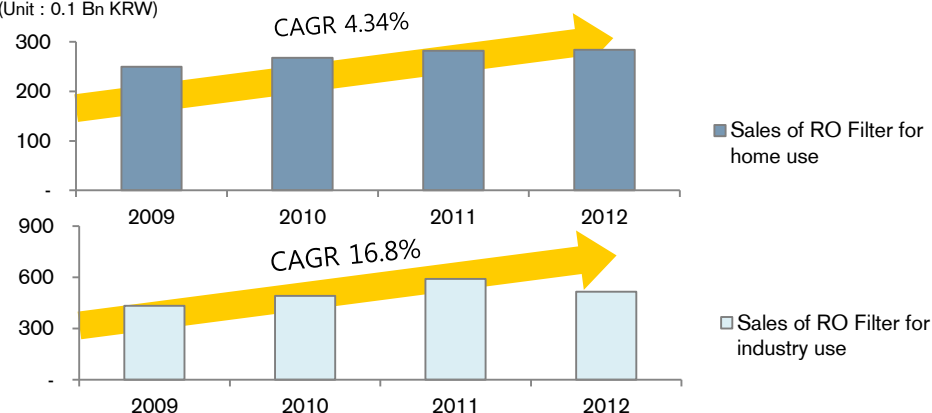
(Unit : Bn USD)

Source: Industry Data, Fenero Research

RO filter of Woongjin Chemical is growing rapidly due to industrial filter

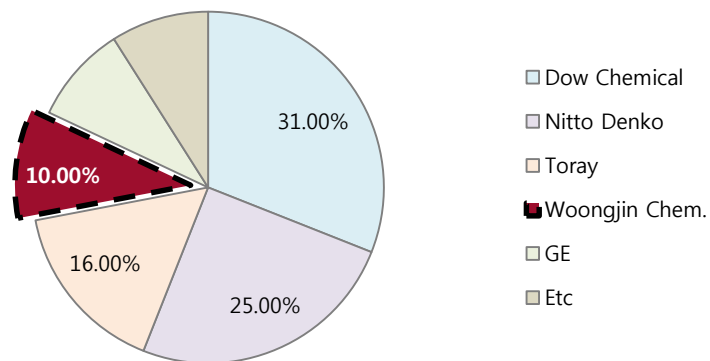
Trend of RO Filter Sales by Use

(Unit : 0.1 Bn KRW)



Source: Industry Data, Fenere Research

RO Filter Global Market Share (2010)



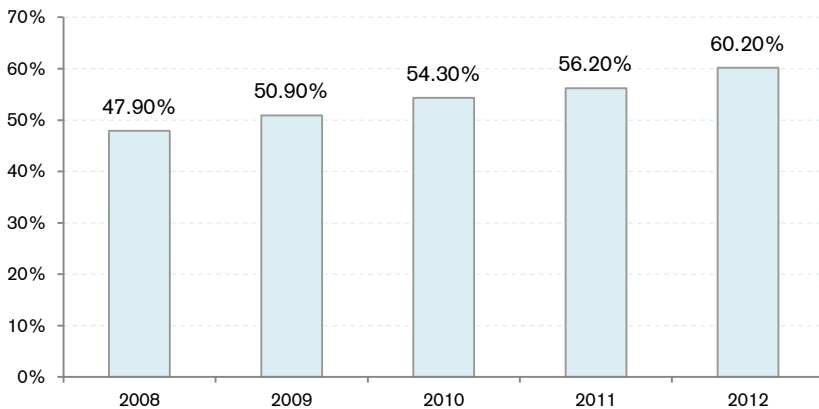
Source: KITA, Fenere Research

Related Information

- Domestic water purifier market is so mature that penetration rate looks like gradual increment. But until now, growth rate hasn't been decreased. Therefore, it will not decrease for several years from now.
- Although domestic water purifier market growth reach the limit, the sales will be maintained safely. The reason is that even though new water purifier demand disappear, filter replacement demand will be exist continuously.

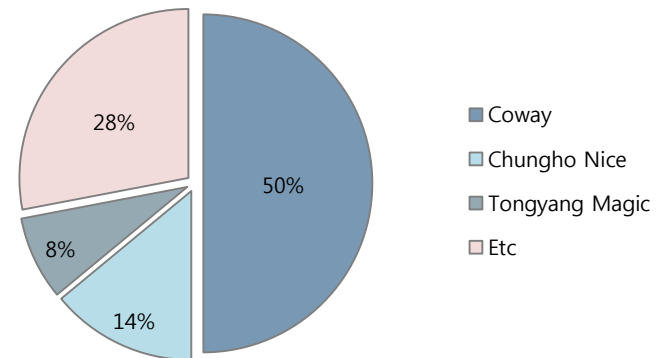
Sales of RO filter for home use will slightly increase

Domestic Penetration Rate of Water Purifier



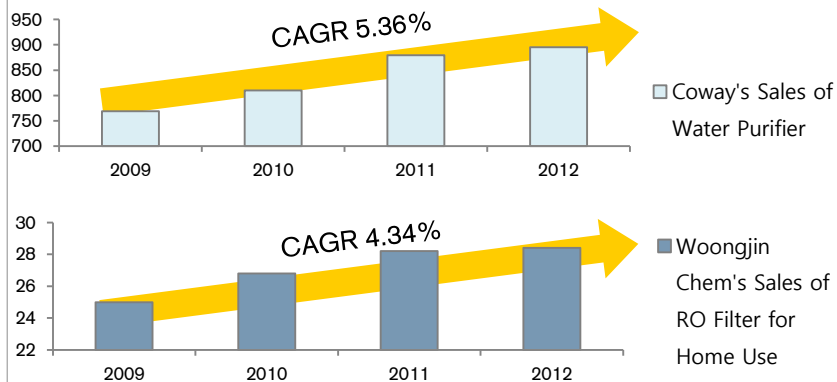
Source: Industry Data, Fenere Research

Domestic Market Share of Water Purifier (2012)



Source: LG Chem, Fenere Research

Comparison to Sales Increasing Rate



Source: Industry Data, Fenere Research

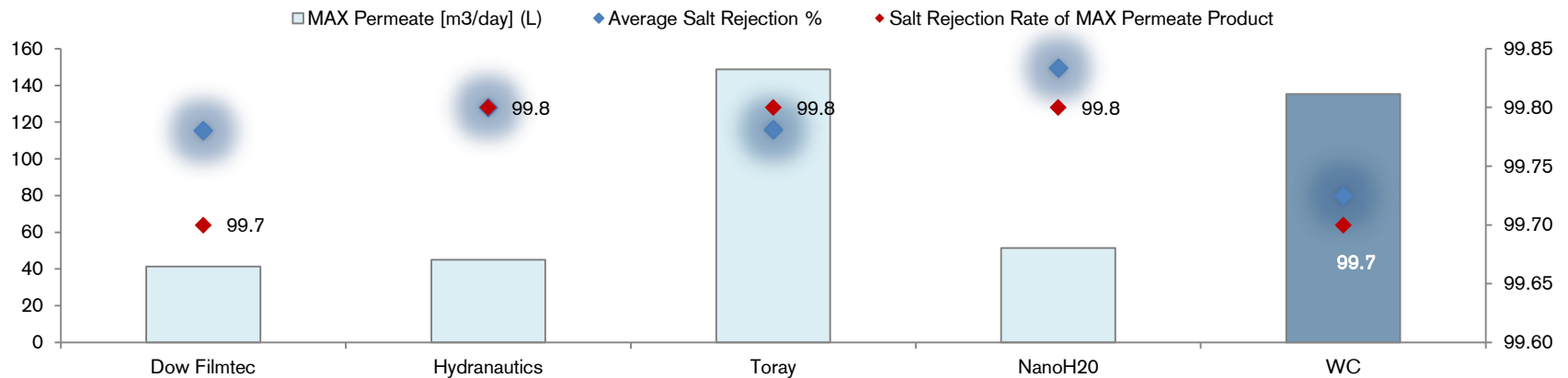
Domestic Market Share of Water Purifier (2012)

- RO filter divided into resident use and industrial use. In the case of resident RO filter, growth rate is gradual. On the other hand, growth rate of industrial RO filter is sharply increasing. Therefore, the portion of resident RO filter in total RO filter is decreasing.
- Type of RO filter market is oligopoly. Woongjin Chemical takes 4th position in RO filter M/S and most research report assert that Woongjin Chemical nearly caught up Toray which takes 3rd position.

Source: LG Chem, Fenere Research

Technology of industrial RO filter is a little bit fall behind, but possible to differentiate by large size product

Overall Comparison



Source: Industry Data, Fenero Research

Domestic Penetration Rate of Water Purifier

Company Name	Model Name	Performance			
		Membrane Area(ft2/m2)	Permeate Flow Rate		Stabilized Salt Rejection %
			GPD(Gallon Per Day)	[m3/day]	
Dow Filmtec	SW30ULE-400i	400 (37)	11,000	41	99.7
Hydranautics	SWC6	400 (37)	12,000	45	99.8
Toray	TM820L-400	400 (37)	12,200	46	99.8
NanoH2O	Qfx SW 400 ES	400 (37)	13,700	51	99.8
Woongjin Chem.	RE8040-BE	400 (37)	10,500	40	99.7

Source: KITA, Fenero Research

Overview of LG Chem



About LG Chem

LG Chem is the 13th ranking in KOSPI (Market Capital: 19 trillion). The firm has 3 business areas, which are petrochemical products, secondary battery, and IT&E materials. Recently, LG group is interested in membrane industry. Therefore, there will be additional one business area in LG Chem soon.

Long history and good corporate governance

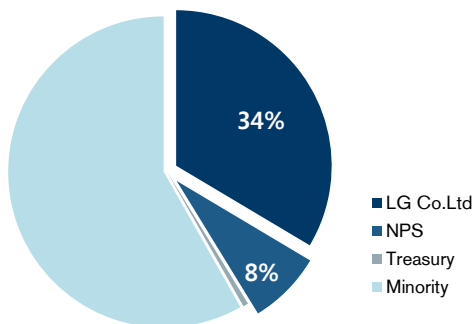
Introduction of LG Chem.

Introduction

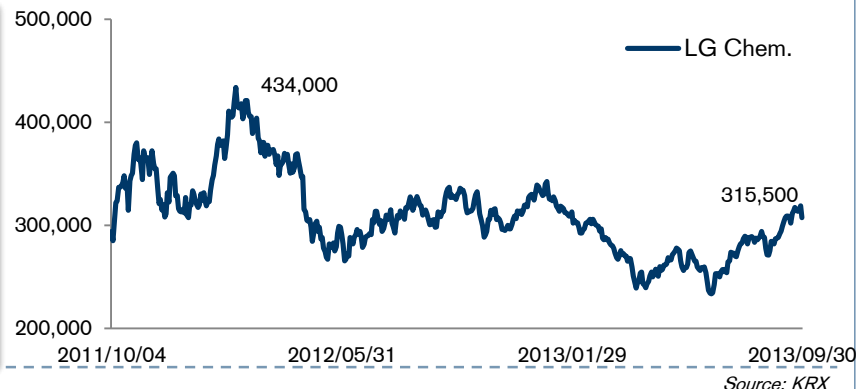


- CEO : Hae Sun, Lee
- Current Business Sector
 - Petrochemical
 - Electric Materials
 - Secondary Battery

Shareholding Structure



Stock Performances



Timelines of LG Chem.

Source: DART

Source: KRX

1 st Generation	2 nd Generation	3 rd Generation	4 th Generation
1980's and Earlier	1990, Growth and take off	2000~2004, Soaring up	2005~Present, Global No.1 Chemical Company
<ul style="list-style-type: none"> <u>OCT 1969</u> Listed on Korea Stock Exchange <u>MAR 1966</u> Established Korea's first synthetic detergent plant in Anyang <u>JAN 1966</u> Renamed to Lucky chemical Industries Co., Ltd <u>JAN, 1947</u> Established as Lucky Chemical industrial Corporation (manufacturing of cosmetics begun) 	<ul style="list-style-type: none"> <u>OCT 1999</u> Completed Construction of plant for rechargeable batteries, phosphors and CCL and IT&Electric Materials <u>FEB 1999</u> Issued two million global depository receipts <u>OCT 2004</u> Completed construction of Lucky Research Park <u>APR 1993</u> Developed and Marketed Industry's first HSFC-resistant synthetic resin. 	<ul style="list-style-type: none"> <u>DEC 2004</u> Established LG Chem(China) Investment Co., Ltd <u>OCT 2004</u> Established an SBL Manufacturing subsidiary in Ningbo, China <u>JUN 2003</u> Established an IT&electronic Materials subsidiary in Nanjing, China <u>DEC 2002</u> Completed expansion of the PVC plant in Tianjin, China (100,000 MT) <u>OCT 2002</u> Completed expansion of Ningbo ABS plant in China (120,000 MT) 	<ul style="list-style-type: none"> <u>2012</u> Established a petrochemical joint venture in kazakhstan <u>IOCT 2010</u> Stated Construction of automotive battery in Michigan, USA <u>JAN 2010</u> Established HL Green Power Co., Ltd, a joint venture with Hyundai Mobis <u>SEP 2009</u> Started construction of TFT-LCD Glass plant <u>SEP 2008</u> Developed and produced elastomer (high-value-added resin) <u>NOV 2007</u> Merged with LG Petrochemicals Co., Ltd <u>JAN 2006</u> Merged with LG Daesan Petrochemicals Co., Ltd <u>JUN 2005</u> Established a marketing subsidiary in Europe

Source: Company Data, Fenero Research

Global Network of LG Chem.

- Manufacturing Subsidiaries : China, Taiwan, Vietnam, India(Visakhapatnam), Poland, USA(Holland, MI), Kazakhstan
- Marketing Subsidiaries : China, USA, Brazil, Europe(Germany), India(Mumbai), Turkey
- R&D Centers : USA(Troy, MI), Japan(Tokyo)
- Representative Offices : Moscow, Ho Chi Minh, Bangkok, Jakarta, Singapore, Tokyo, Bogota
- Korea : Seoul Head Office, Research Park and Domestic Plants

Overseas Manufacturing Subsidiaries

12

Overseas Marketing Subsidiaries

21

Branch Offices

7

Research Subsidiaries

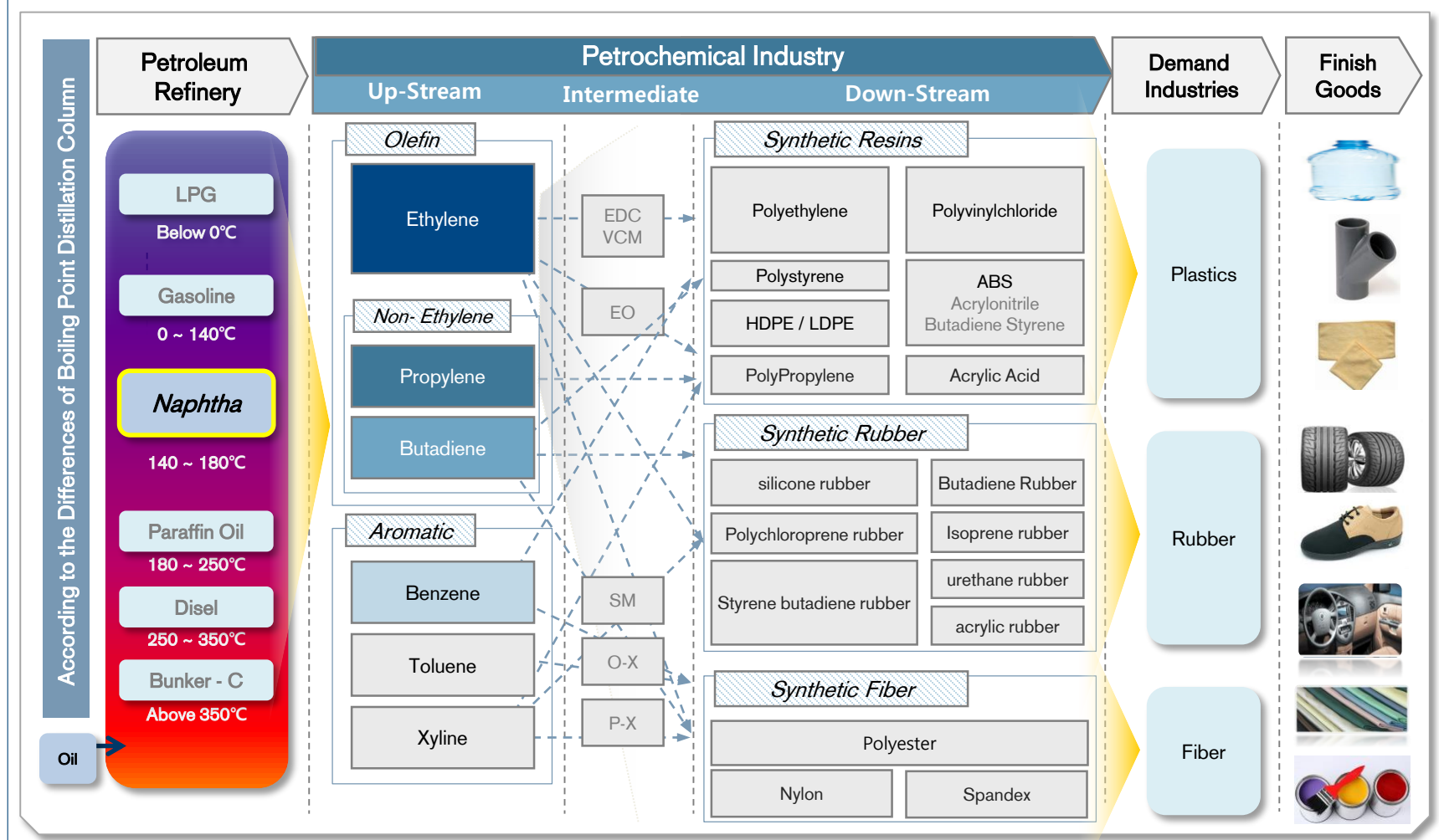
2

LG Chem. Employs over 20,000 People
in 15 Countries (as of Dec. 2012)

Source: Industry Data, SG Fenero Research

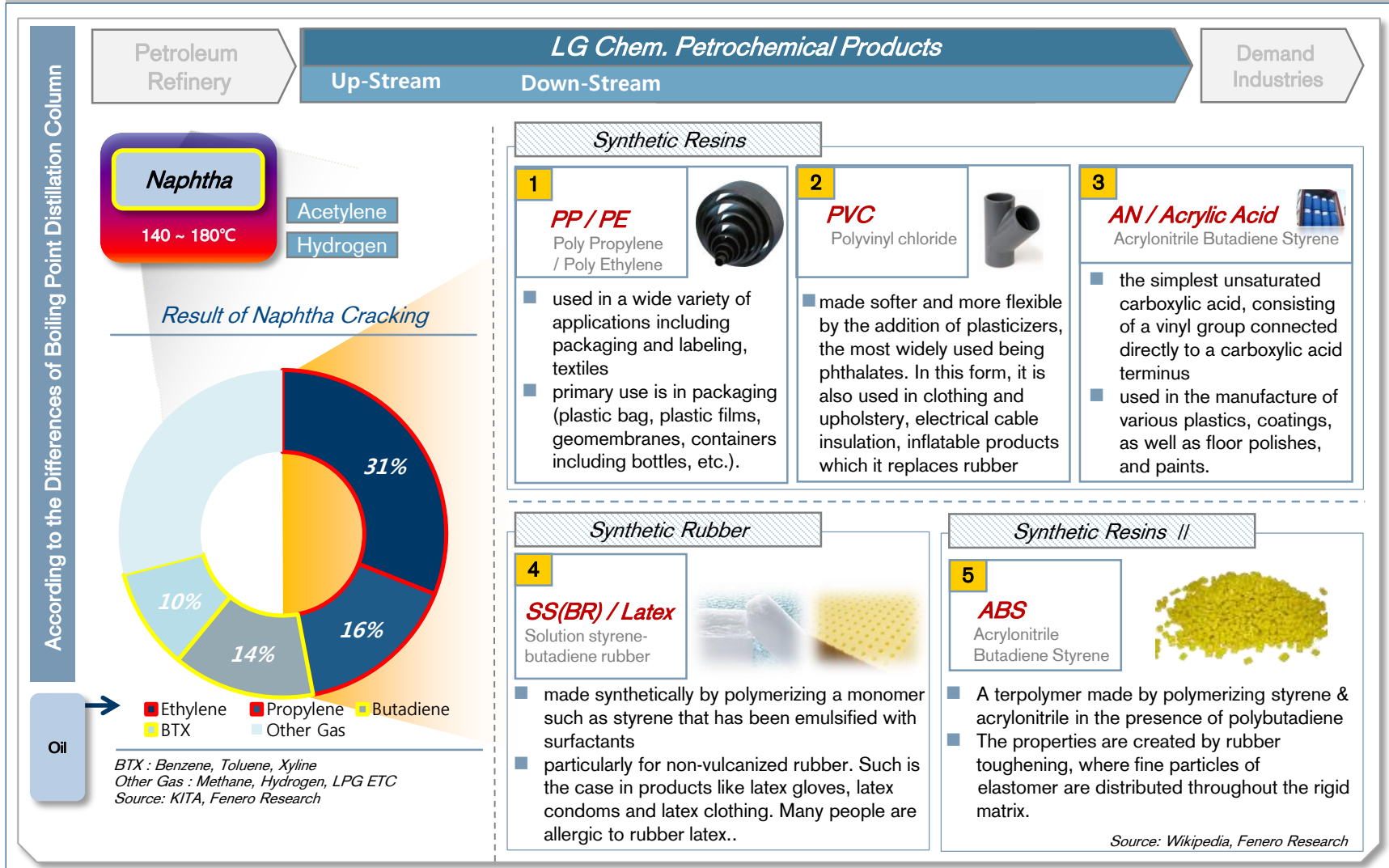
Industry is proceeded by making products with various synthesis

Macro Value chain of Petrochemical Industry



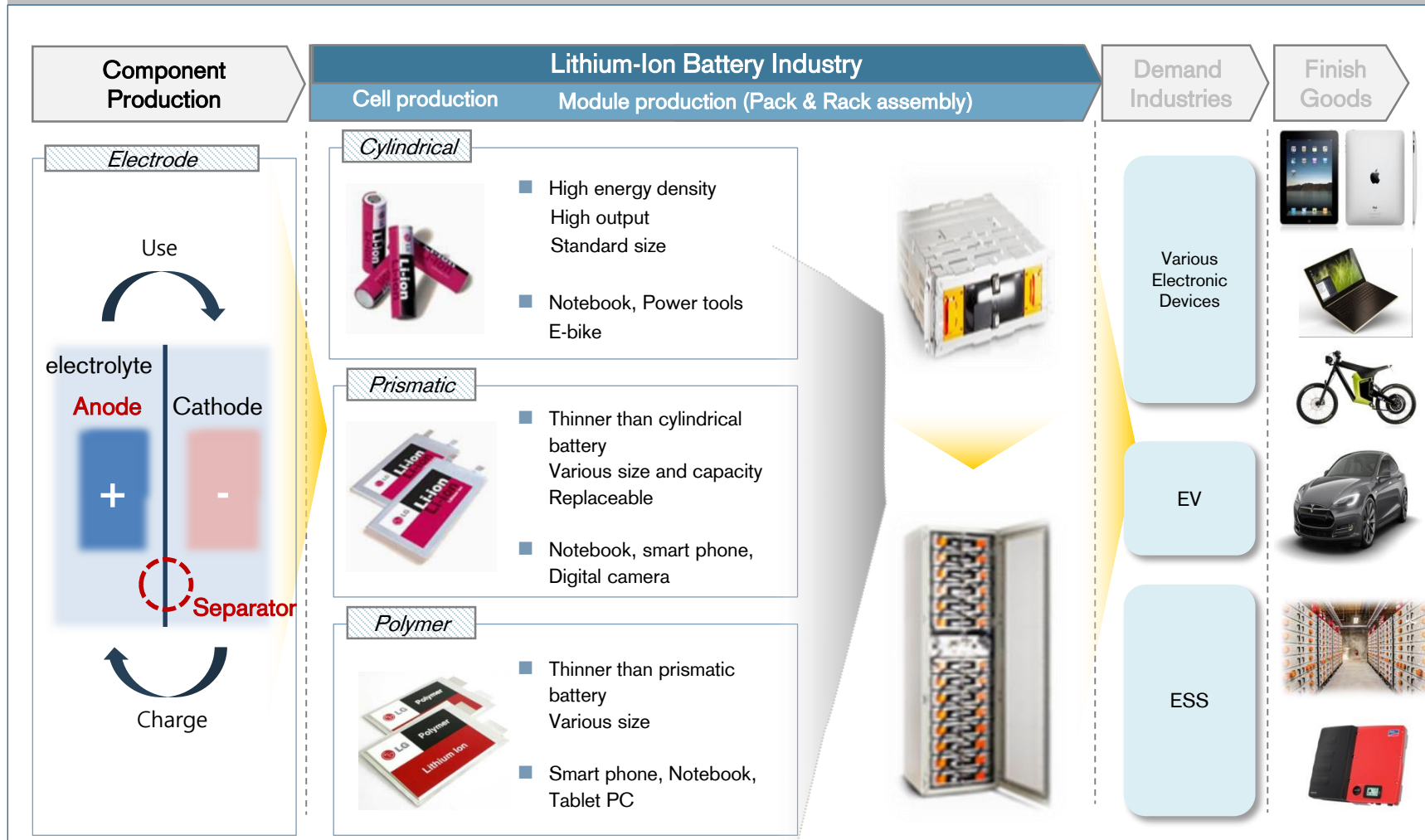
LG Chem. has proceeded by making products with various synthesis

Micro Value chain of LG Chem. Petrochemical Products



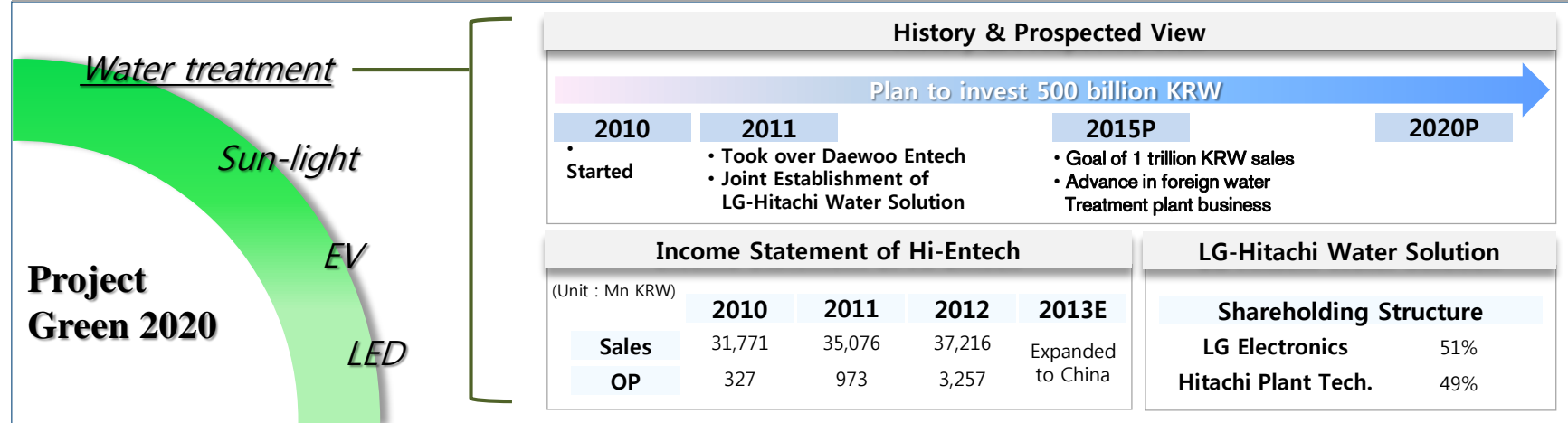
Industry is proceeded by making products with various synthesis

Value chain of Lithium-Ion Battery Industry



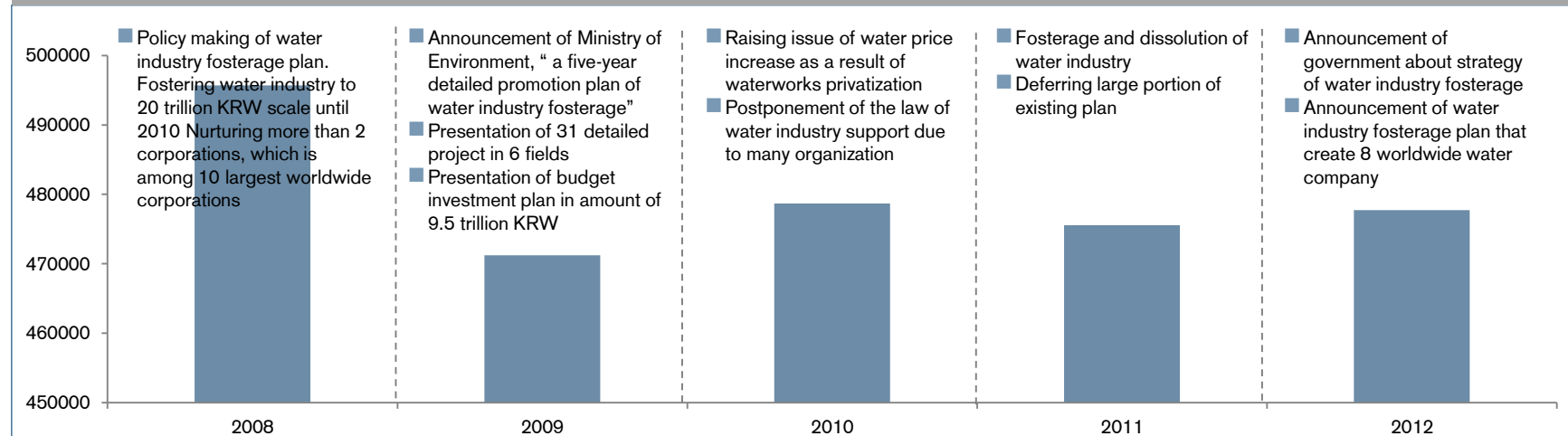
LG Group entered into Water Industry

Green 2020



Source: KISLINE, Fenero Research

Selecting water industry as a new growth power industry by government



Source: Global Water Intelligence, Water Channel, Fenero Research *Plan Of Government Sewage Treatment Equipment*

Synergy Analysis



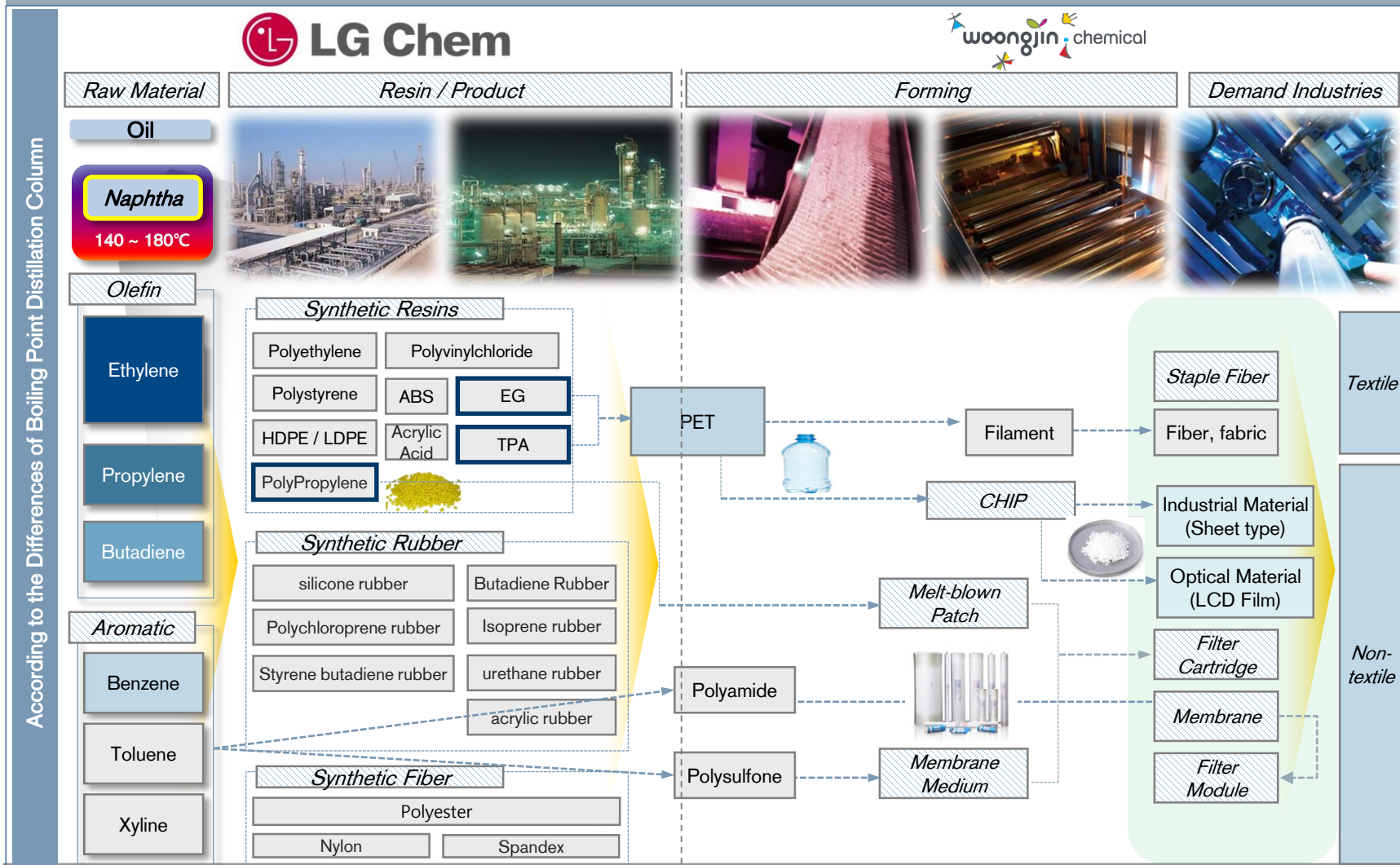
About Expected Synergy

3 major synergies will be caused in Filter, Fiber, and Material areas each. First of all, the trend of water treatment is vertical systematization. This is also expected to M&A of Woongjin Chemical and LG Chem. In fiber business, also vertical systematization is expected because LG Chem takes part of up-stream industry of fiber (petrochemistry) and Woongjin Chemical takes part of manufacturing fiber. Lastly, optical materials will expand capacity by M&A.

1.3. Consolidated Value Chain

Possibilities of Vertical Integrated Value Chain

Hypothesis TOTAL Value Chain after M&A



Source: SG Fenero Research

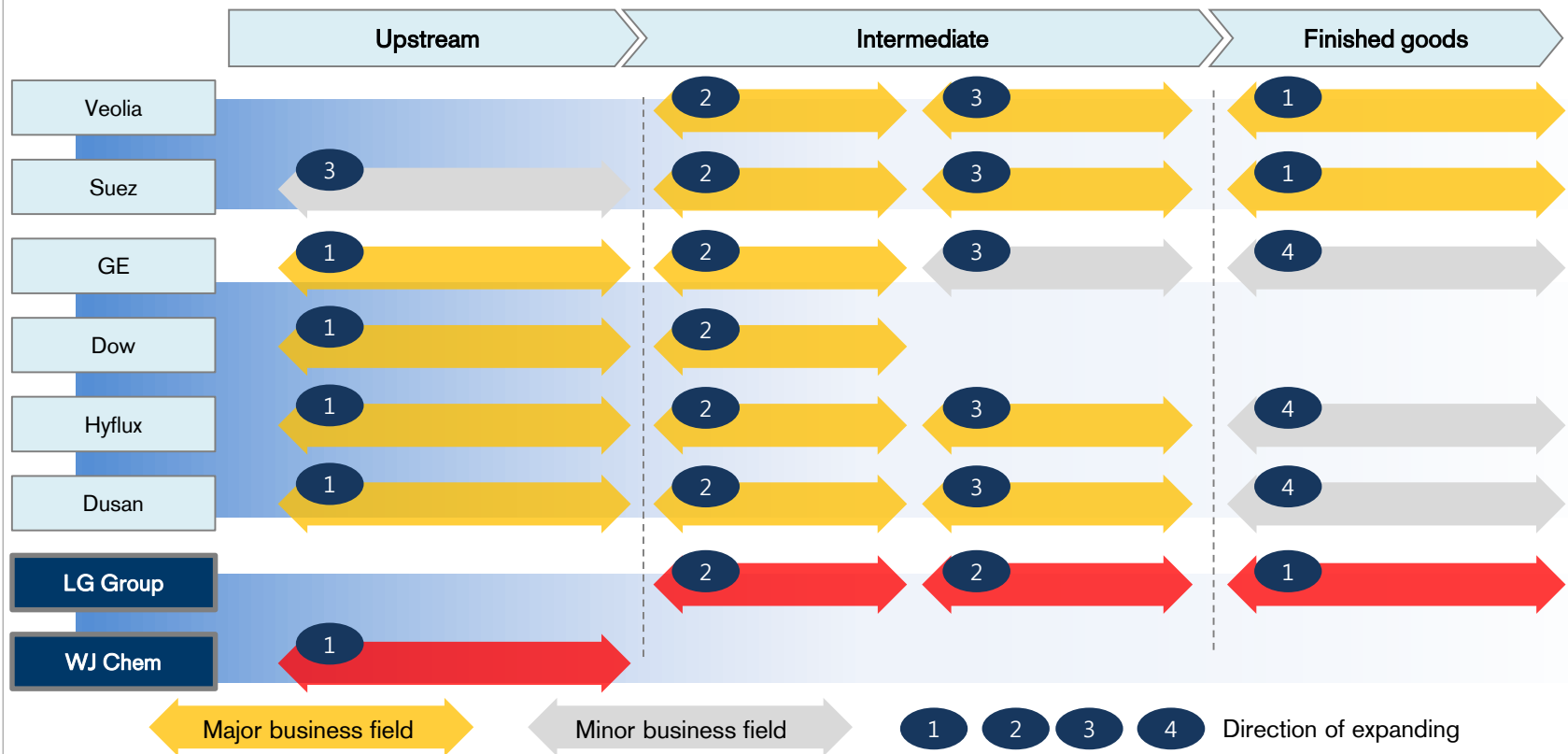


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Synergy 1. Value Chain of Key Players

LG group can successfully enter the global water industry through M&A with WJ Chem

Business fields of key players of Water industry



- Key players of water industry have diversified their fields of business either from O&M to core parts production or from core parts production to O&M.
- LG group has exerted itself to enter O&M of water industry but there is no outstanding achievement for it does not have any references in water industry.
- It can not only diversify its fields of business in water industry but successfully make inroads in the global water industry

Source: Industry Data, SG Fenero Research

Reference Before 2000

By selling most of filters in domestic companies, Woongjin Chemical gain domestic reference

Filter Transactions - Domestic

Date	Company	Scale (ton/hour)	Date	Company	Scale (ton/hour)	Date	Company	Scale (ton/hour)
1995.10	Samsung Electronics	10	1997.12	SK	120	1998.09	Hyundai Motors	200
1996.03	SKC	10	1997.12	Samsung Medical Center	3	1999.04	Busan Cogeneration	100
1996.09	Anam S&T	30	1998.01	KEPCO	100	1999.04	Hyundai Motors	15
1996.12	KIA Motors	400	1998.01	Korea Electronic	100	1999.05	Samsung Electric	80
1996.12	KEPRI	Radioactive Liquid Waste Treatment	1998.03	POSCO	60	1999.05	Shinan-gun County Office	100
1997.07	Doosan Electronics	30	1998.03	Samsung Thales	60	1999.05	LG Siltron	120
1997.07	Samsung SDI	250	1998.03	Hyundai Motors R&D Center	100	1999.08	Myungsin Chemical	20
1997.08	Cheongho Fine	For replacement	1998.05	Samsung Corning Fine Glass	20	1999.08	Samsung Electric	20
1997.10	Samsung Electric	30	1998.06	ROK Navy	320 EA	1999.10	Samyang Fiber	190
1997.10	Samsung Electronics	100	1998.07	LG Siltron	30	1999.10	Samsung Electronics	15
1997.10	Samsung Engineering	Recycle Test	1998.08	Dongbu Steel	540			

Source: CSM News, Fenero Research

Filter Transactions - Export

Date	Location	Scale(ton/hour)	Filter
1997.10	Shanghai, China	50	RO
1998.12	Shanghai, China	2	RO

Source: CSM News, Fenero Research

Completions/R&Ds

Date	Contents
1994	Production of RO filter for residential use
1996	Production of RO filter for industrial use

Source: CSM News, Fenero Research

Reference After 2000

By exporting and R&D, Woongjin Chemical gains international certifications and prizes

Filter Transactions - Foreign(Date Order)

Date	Location	Scale (ton/hour)	Filter	Date	Location	Scale (ton/hour)	Filter
2005.09	U.S.A.	47	RO	2009.03	Australia	\$230,000	CRM RO
2006.07	Singapore	1,693	RO	2010.06	Iran	5,417	CRM RO
2007.03	Iran	8,830	RO	2012.12	ROSA	\$420,000	N/A
2008.01	Singapore	2,423	CRM RO				

Source: CSM News, Fenero Research

Filter Transactions - Domestic

Date	Company	Scale (ton/hour)	Filter
2000.01	LG Fine	10	RO
2006.07	Seoul	19	NF
2011.1~6	Total	\$1 million	RO, NF, MF

Source: CSM News, Fenero Research

Completions/R&Ds

Date	Contents
2003.12	Completion and operation of Gumi Factory(4 times increment from 200m ² to 800m ²)
2006.07	Co-research program with universities(Georgia Engineering University, Hawaii University, SNU, Korea University)
2007.10	Development of CRM RO filter(4~5 times high chloride resistance for existing RO filter)
2008.01	Improvement and production of 16-inches RO filter
2011.04	Completion of filter production factory in Anaheim, California, U.S.A
2011.12	Localization(home country producing) of MF filter
2013.01	Development of CSMPPro v5.0 (able to analyze the cost of equipment and maintaining RO filter automatically)
2013.07	Contract of investment about FO filter(alternative RO) development with Porifera Co. in amount of \$1 million

Source: CSM News, Fenero Research

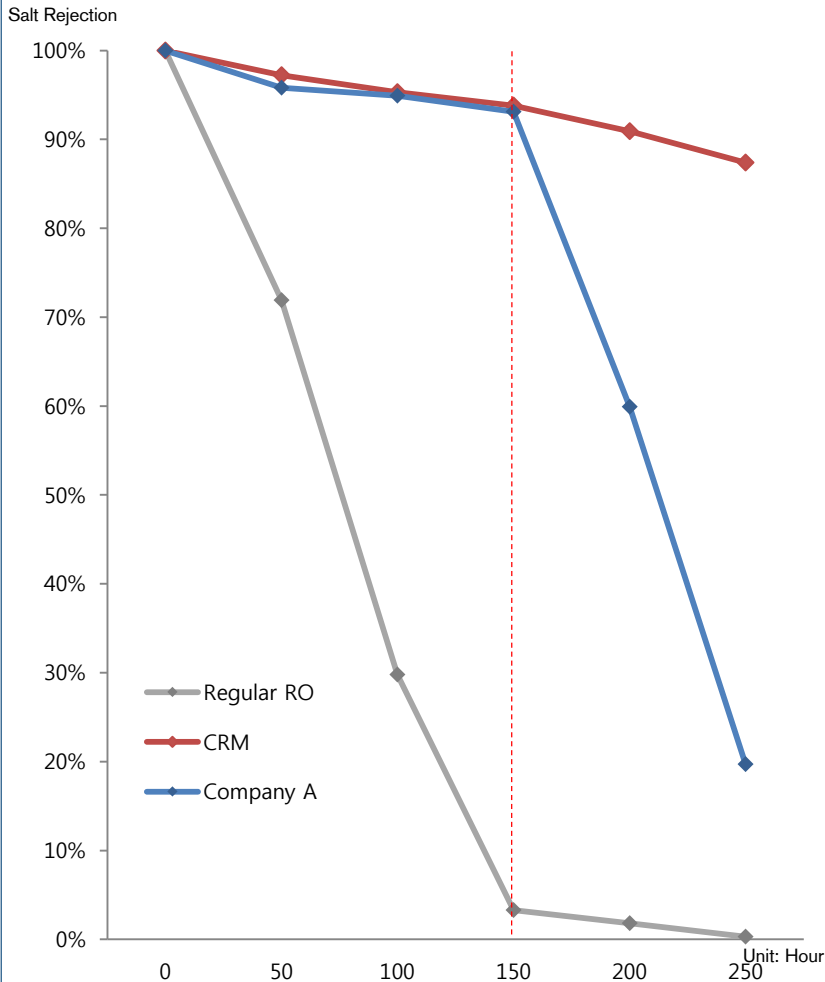
Awards/Certifications

Date	Contents
2002.10	Prize from Prime Minister about seawater RO filter in Newtech Korea
2004.04	Achievement of NSF 58 and 61 about residential membrane (NSF: National Sanitation Foundation, U.S.A.)
2006.03	Host of the first desalination symposium at AWWA (AWWA: American Water Works Association)
2006.07	Environmental management grand prize from the ministry of commerce, industry, and energy
2008.03	The outstanding result of test about CRM RO
2008.09	Participation dominantly about domestic large desalination project (\$170 million from government for 6 years)
2012.07	Selected as vendor from SWCC (SWCC: Saline Water Conversion Corporation)
2012.10	NSF61 achievement of America Co. (BW product, FRM product, NF product)
2012.10	Equipped CSM 16-inches RO filter in Scottsdale Watercampus, America

Source: CSM News, Fenero Research

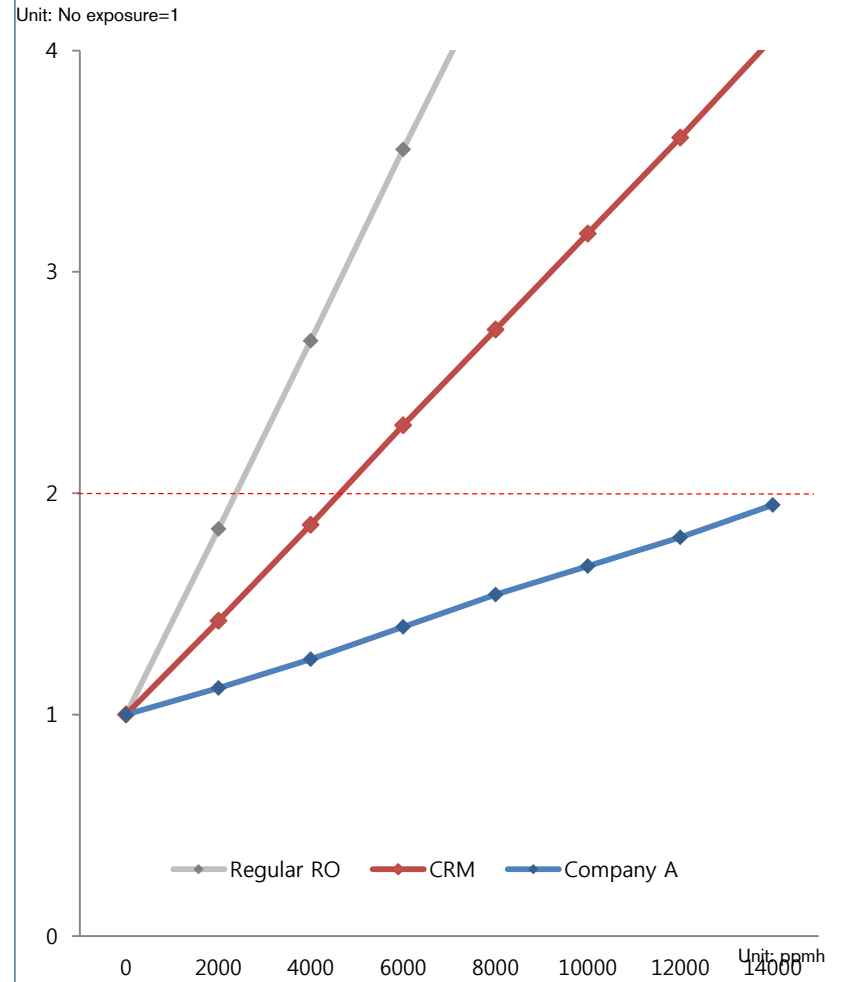
Similarly to reference, the ability of CRM RO is outstanding compared to existing RO and competitor's product

Filter ability changes by time of exposing chloride



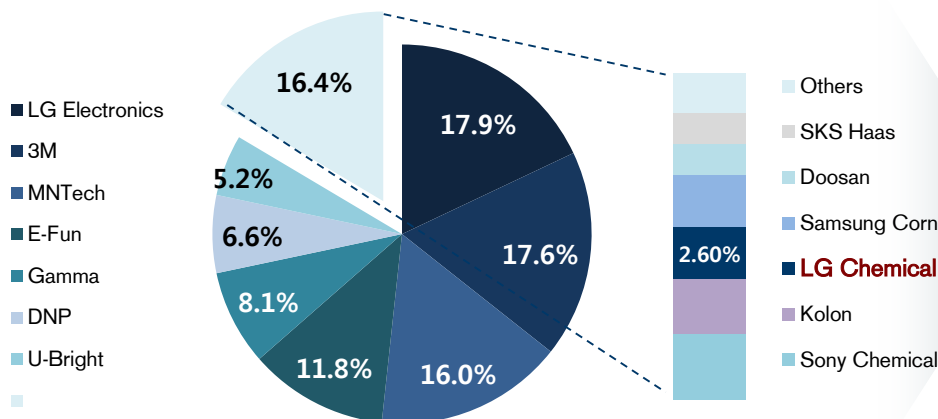
Source: SG Fenero Research

Comparison of chloride penetration



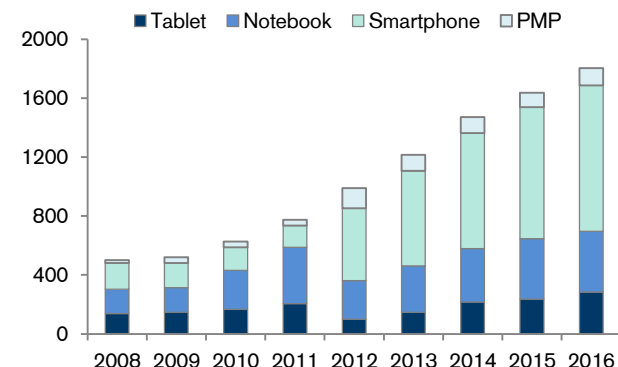
WC's Optical Material Department can create opportunities for turnaround ensuite.

LG Electronics occupied 1st area of World Prism Film Market



Source: Industry Data, Fenere Research

Demand Trends of Prism Film Market



Domestic Penetration Rate of Water Purifier

LUMICEL

LUMICEL is a material for LCD BLU and LED lighting. This diffuser plate is a new concept that can respond to the ever-increasing, upscale electronic display business. Not only does this plate use ecofriendly materials, but it has high optical properties, impact resistance and stability, as well as high heat resistance.

LUMISM

This prism sheet for LCD BLU applies extrusion engraving technology for the first time in Korea, manufacturing sheets and configuring prisms at the same time, significantly simplifying the previous manufacturing process. Its thickness is in the range of 200~600μm. Also this eco-friendly product uses materials with high heat resistance and low absorbing ability, acquiring dimensional stability.

Domestic Market Share of Water Purifier (2012)

Complete Device

LG Electronics



Display Component

LG Display



Upstream Materials

LG Chem



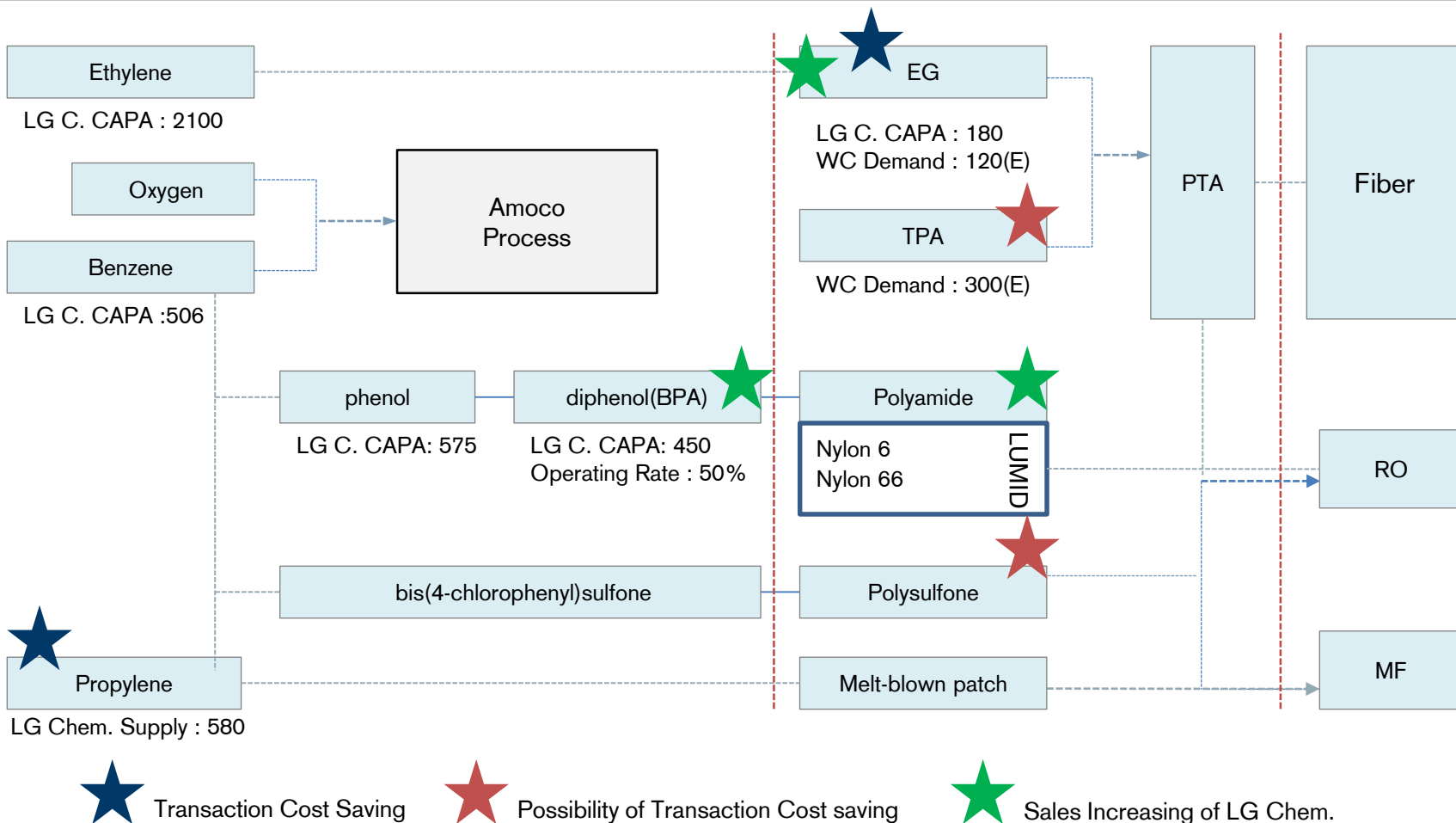
Downstream Materials

woongjin chemical



Product link between LG Chem. and Woongjin Chem. will create a big synergy effect

Entire Product Link Process

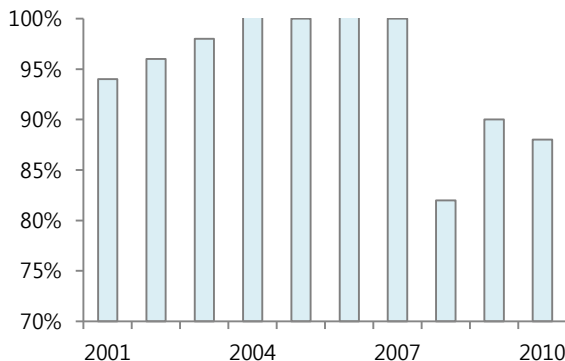


Source: Industry Data, Fenero Research

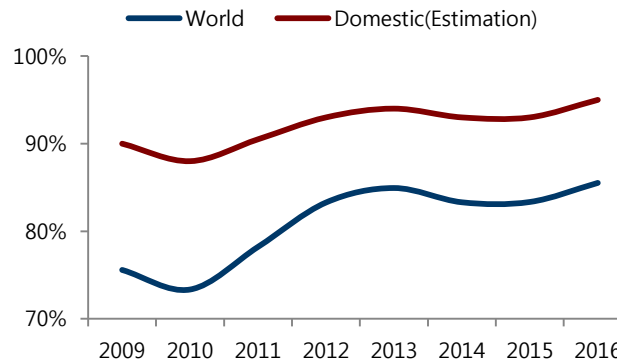
EG operating rate of LG Chem. will move up to 100% causing increase of sales

Domestic Penetration Rate of Water Purifier

Domestic Rate of Operation – EG Part

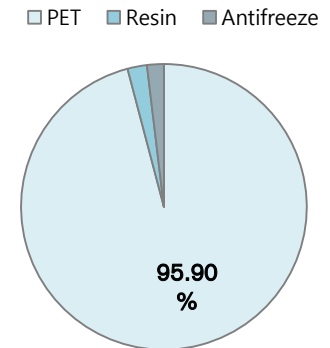


Rate of Operation – EG (Forecasting)



Source: KPIA, PCI, Fenero Research

Domestic Demand Present Condition of EG (2010)



Computational prediction

Domestic Rate of Operation – EG Part

	2011	2012	2013H	Unit
Exchange Rate	\$1,174	\$1,095	\$1,103	USD
Unit cost of purchase	\$1,108	\$1,127	\$998	USD
Conversion to \	1,300,924	1,233,929	1,100,794	KRW
Purchases of Raw Material	846,683	690,284	324,201	Mn KRW
Ratio of EG	21%	20%	20%	
Purchase of EG	177,803	138,057	64,840	Mn KRW
Purchase amount of EG	136.7	111.9	58.9 (117.8 / Y)	Thousand Ton

- Capacity of LG Chem.'s EG : 180 Thousand Ton
- Woongjin Chem's EG demand ratio contrasted with LG Chem's entire capacity is between 62~76%
- If Woongjin Chem. Changes their EG supplier to LG Chem. more than 10%, LG Chem. can always maintain their EG operating rate to 100%

Source: DART, Fenero Research

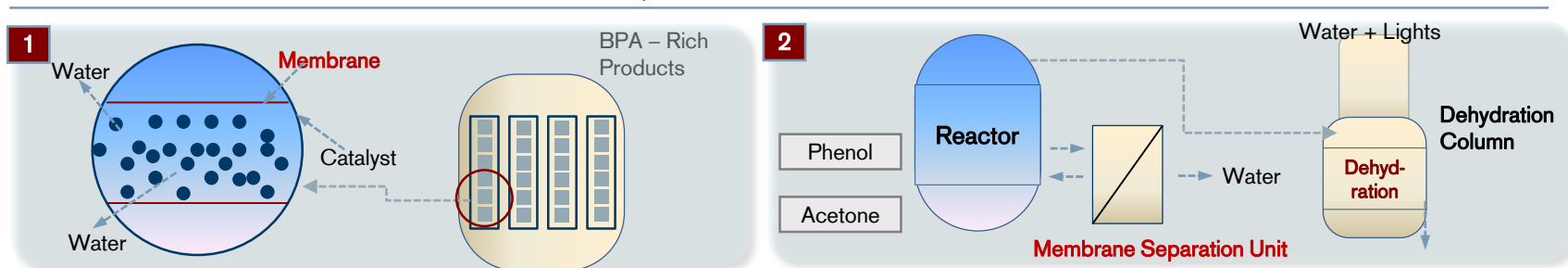
LG Chem. will be able to contract swap option on favorable terms with Woongjin Chem.'s assistance

Membrane Sales of Woongjin Chem. Side

"Every Factory with stack needs membrane filter"

- RO filter is widely used in most industry sectors
- Especially, almost the whole chemical factory needs membrane filter
- Membrane sales of Woongjin Chem. will increase considerably

Example – LG Chem's BPA Process



Source: Global Water Intelligence, Fenero Research

Interest Swap Option Side

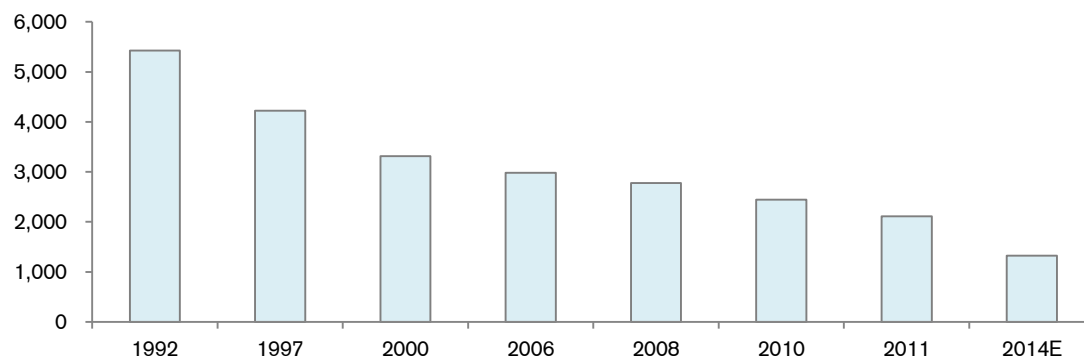
	Contracting agency	Interest of receiving (%)	Interest of payment (%)	Borrowed principal	Payoff (%) (Assumption : CD, LIBOR 4%)
Woongjin Chem.	Kyongnam bank	CD 3M + 1.88	5.38	₩ 10,000,000	0.5
	SC bank	LIBOR 3M + 1.3	5.4	₩ 10,760,000	-0.1
LG Chem.	HSBC	CD 3M	4.61	₩ 3,000,000	-0.61
	HSBC	LIBOR 3M	5.59	\$ 4,500	-1.59

Source: Industry Data, Fenero Research

LG Chem. will be able to contract swap option on favorable terms with Woongjin Chem.'s assistance

Technology Transfer - LG Chem.'s High Energy Efficiency

Declining Trend of Energy source - Yeosu NCC Factory

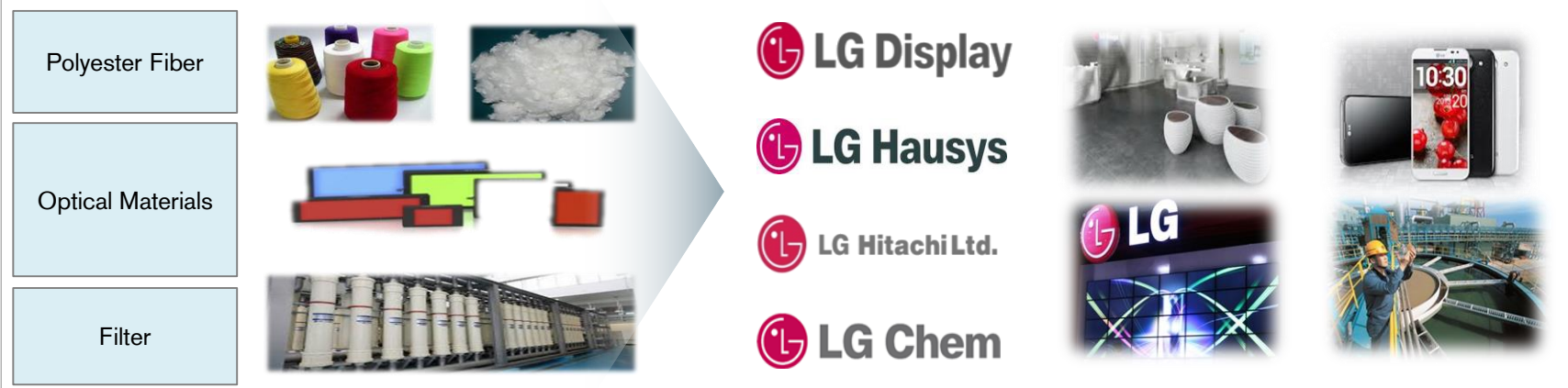


■ Manufacturing cost of NCC factory to the exclusion of raw material cost is comprises 60% by energy

■ LG Chem. uses more than 40% less of energy than other NCC industry average. It has cost-cutting effect about 300 Bn KRW on the basis of one million ton production

Source: Industry Data, Fenero Research

Woongjin Chemical sales source variability to LG Group



Source: Industry Data, Fenero Research

Source: LG Chem, Fenero Research

Amount of Purchase Estimation – Woongjin Chem's TPA

	2011	2012	2013H	Unit
Exchange Rate	\$1,174	\$1,095	\$1,103	USD
Unit cost of purchase	\$1,220	\$1,084	\$1,037	USD
Conversion to ₩	1,432,280	1,186,980	1,143,811	KRW
Purchases of Raw Material	846,683	690,284	324,201	Mn KRW
Ratio of EG	53%	51%	55%	
Purchase of EG	448,742	352,045	178,310	Mn KRW
Purchase amount of EG	313.3	296.6	155.9 (311.8 / Y)	Thousand Ton

Source : Informax, DART, Fenero Research

Amount of Purchase Estimation – Woongjin Chem's Polyamide

	2011	2012	2013H	Unit
Exchange Rate	\$1,174	\$1,095	\$1,103	USD
Unit cost of purchase	\$3,500	\$3,500	\$3,500	USD
Conversion to ₩	4,109,000	3,832,500	3,860,500	KRW
Purchases of Raw Material	846,683	690,284	324,201	Mn KRW
Ratio of EG	2%	2%	5%	
Purchase of EG	16,934	13,806	16,210	Mn KRW
Purchase amount of EG	4.1	3.6	4.2 (8.4 / Y)	Thousand Ton

Source : Informax, DART, Fenero Research

Valuation



Valuation of Woongjin Chemical and Synergy Valuation

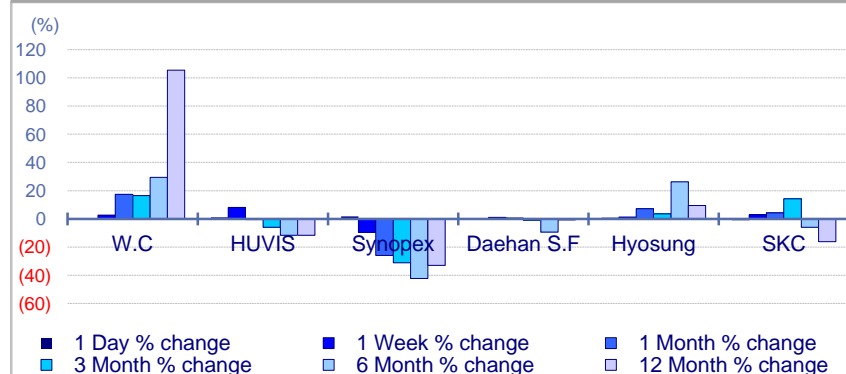
We predict 5-year pro forma financial statement(2013-2017). we used DCF valuation to evaluate Woongjin Chemical by using pro forma. And then, we also performed synergy valuation. We put total synergies together to conduct synergy valuation. Finally, we compute enterprise value and undertaking price.

Valuation Analysis - DCF

Financial Records of LG Chem.

	2013(E)	2014(E)	2015(E)	2016(E)	2017(E)
Sales	1,051,514,544,084	1,145,335,122,174	1,251,285,179,996	1,371,758,213,453	1,510,612,262,437
COGS	910,416,730,600	980,708,283,005	1,058,916,563,632	1,147,150,872,751	1,248,163,277,367
Gross Profit	141,097,813,483	164,626,839,169	192,368,616,365	224,607,340,702	262,448,985,070
SG&A	102,195,385,358	110,757,611,183	120,035,532,328	131,559,194,805	143,879,669,871
EBIT	38,902,428,126	53,869,227,986	72,333,084,037	93,048,145,898	118,569,315,198
EBIT(1-t)	29,954,869,657	41,479,305,549	55,696,474,709	71,647,072,341	91,298,372,703
Depreciation	31,599,419,903	33,444,639,581	32,872,688,990	32,045,736,577	32,390,253,150
Amortization	839,864,512	839,858,833	839,858,833	839,858,833	839,858,833
△NWC	(11,847,948,062)	31,555,456,971	(9,927,255,846)	41,339,534,135	144,748,281
△CAPEX	61,161,763,800	64,552,776,771	67,502,440,911	71,082,150,709	76,228,347,717
FCFF	13,080,338,334	(20,344,429,779)	31,833,837,467	(7,889,017,092)	48,155,388,688

Price Performance Comparison with Peer Group



Source: Dataguide

Price Performance Comparison with Peer Group

PV of FCFF	47,297,822,152	Outstanding Shares	46,363,851
Terminal Growth Rate	3%	WACC	7.79%
PV of Terminal Value	712,022,699,640	Target Price	10,044
Enterprise Value	759,320,521,792	Current Price	11,500
Less: Debt	293,635,186,034	Potential Growth	-12.66%
Equity Value	465,685,335,758		

Valuation Analysis – DCF(Adding Synergy Value)

	2013(E)	2014(E)	2015(E)	2016(E)	2017(E)
Sales	1,051,514,544,084	1,145,335,122,174	1,251,285,179,996	1,371,758,213,453	1,510,612,262,437
+Synergy		5,825,076,615.57	12,580,847,148.23	20,526,210,273.33	29,966,011,540.50
COGS	910,416,730,600	980,708,283,005	1,058,916,563,632	1,147,150,872,751	1,248,163,277,367
+Synergy		(11,179,366,174.61)	(11,303,078,192.14)	(6,068,656,071.62)	42,903,447.10
Gross Profit	141,097,813,483	181,631,281,959	216,252,541,705	251,202,207,047	292,372,093,163
SG&A	102,195,385,358	110,757,611,183	120,035,532,328	131,559,194,805	143,879,669,871
+Synergy	(1,036,984,646.98)	(270,608,305.00)	633,646,490.32	1,287,158,210.51	2,065,206,904.39
EBIT	39,939,412,773	71,144,279,081	95,583,362,887	118,355,854,032	146,427,216,387
EBIT(1-t)	30,753,347,835	54,781,094,892	73,599,189,423	91,134,007,605	112,748,956,618
Depreciation	31,599,419,903	33,444,639,581	32,872,688,990	32,045,736,577	32,390,253,150
Amortization	839,864,512	839,858,833	839,858,833	839,858,833	839,858,833
△NWC	(11,847,948,062)	32,530,970,484	(9,076,147,936)	42,623,406,515	1,393,581,877
△CAPEX	61,161,763,800	64,749,436,172	67,927,180,707	71,775,132,531	77,240,025,031
FCFF	13,878,816,512	(8,214,813,349)	48,460,704,475	9,621,063,969	67,345,461,693

Source: Industry Data, Fenero Research

Transaction Structure & Consideration



About Structuring of M&A

LG Chem acquires Woongjin Chemical through 100% of equity financing. CC reserve of LG Chem surpass takeover price of Woongjin Chemical. LG group retains the amount of 500 billion KRW for water treatment business. Also, the lowest CC of LG Chem in past 7 years surpass takeover price of Woongjin Chemical. Current Liability divided by Current Asset ratio is decreasing persistent from 2007.

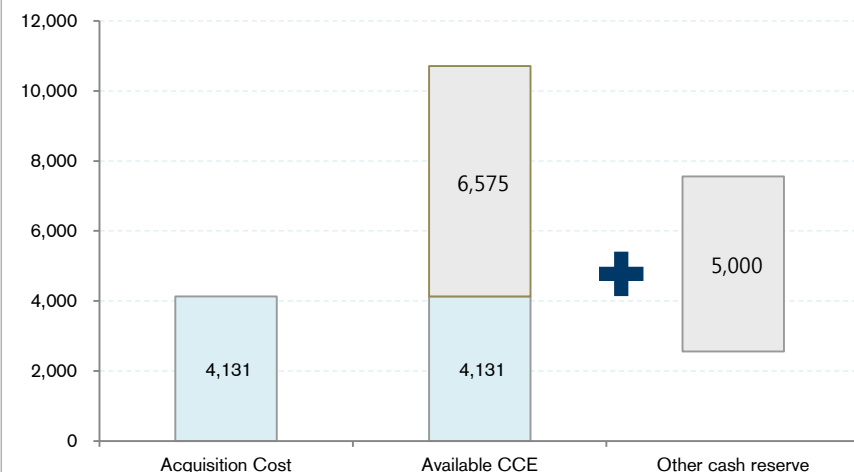
Financial Records of LG Chem.

(Unit : 0.1 Bn KRW)	2007	2008	2009	2010	2011	2012	2H13
Current Asset	3,819,590,000,000	4,633,464,000,000	5,277,147,000,000	6,291,677,000,000	7,256,212,000,000	7,452,938,000,000	8,491,570,000,000
Current Liability	2,924,921,000,000	3,662,510,000,000	3,906,838,000,000	4,277,392,000,000	4,723,904,000,000	4,338,012,000,000	5,137,884,000,000
CL/CA	76.6%	79.0%	74.0%	68.0%	65.1%	58.2%	60.5%
Cash & Cash Equivalent	514,297,000,000	513,664,000,000	1,106,596,000,000	1,368,034,000,000	1,379,379,000,000	720,767,000,000	1,584,272,000,000
MIN Value of CCE (2007-2012)	513,664,000,000						
Difference between MIN CCE & 2H13 CCE	1,070,608,000,000						

Source: Dart

Potential Transaction Structure

(Unit : 0.1 Bn KRW)



Source: Industry Data, Fenero Research

Takeover Price Summary

Enterprise Value without Synergy	396,601,064,769
+	
Synergy Value	271,539,105,802
Managerial Rights Premium	10%
=	
Enterprise Value without Synergy	734,954,187,627
×	
Takeover Rate	56.21%
=	
Takeover Price	413,117,748,865

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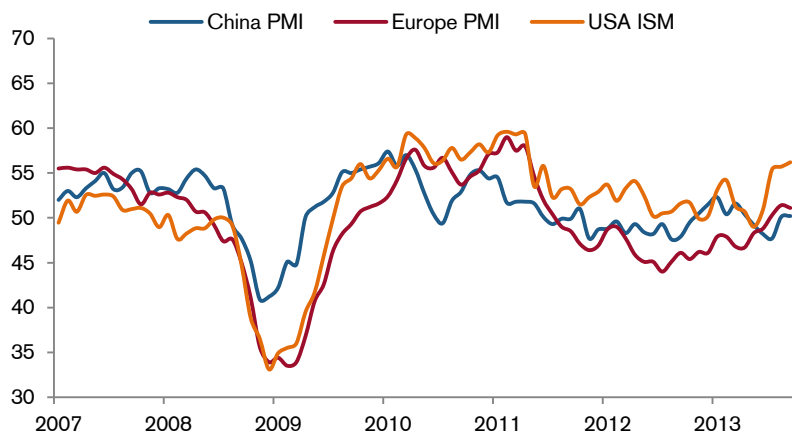
Fenero 13th
Myung ho, Kim
09, Business
+82 10 8441 7445
Kimmyungho55@naver.com

Appendix



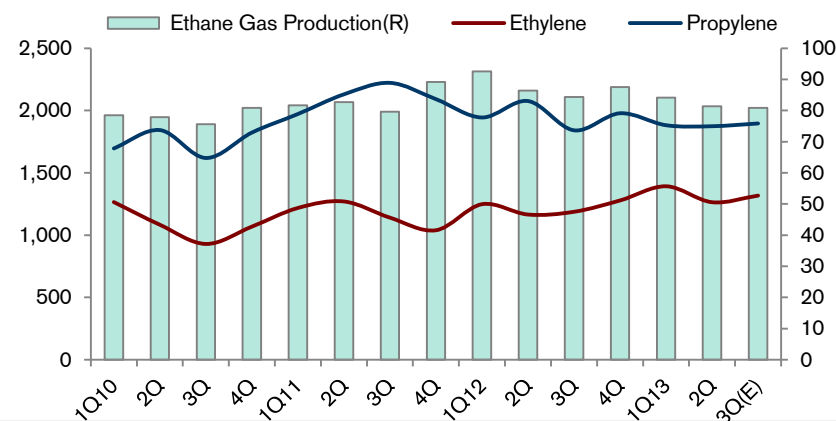
Prospect of chemistry sector is expected to be positive for a while

Trend of the Manufacturing PMI



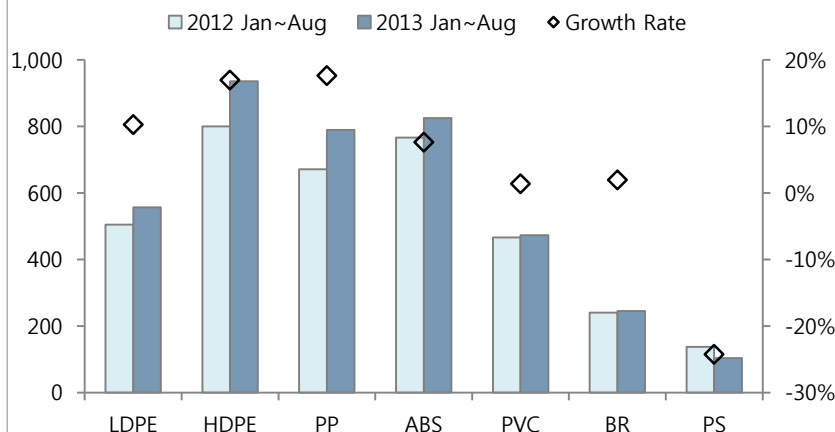
Source: Fenero Research

Price Trend of Ethylene and Ethan Gas Production



Source: LG Chem, Fenero Research

Export Volume Increment by Product



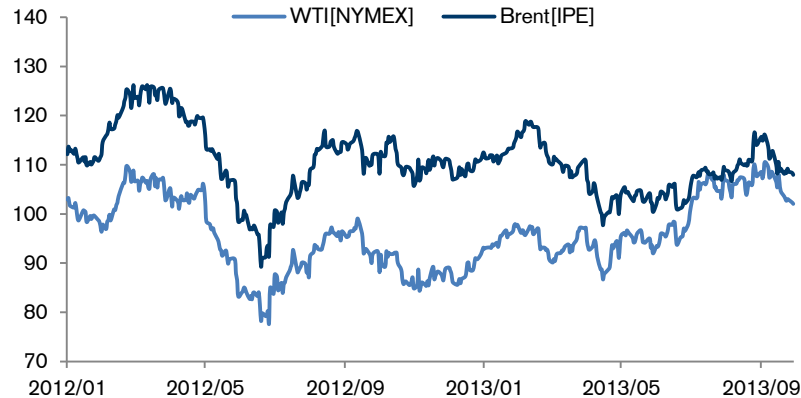
Source: KITA, Fenero Research

Related Information

- It seems that manufacturing industry PMI index of main countries recently get recovery trend.
- Production of Ethylene-Ethane gas will be declined a bit or maintained for a while. As a result, Ethylene price will be stabilized.
- Tracing trend of export by domestic synthetic resins, all the resins increase year on year except PS. It can also be interpreted that chemical industry is gradually recovering. Because of ABS replacement resulting from increase of the PS price, it is evaluated that export of all the petrochemistry products is larger in substance.

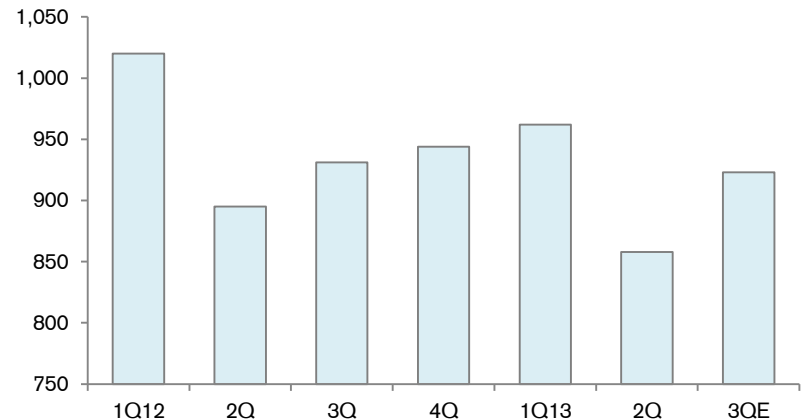
Due to more competitive on cost of LG Chem, operating margin will go up

Futures Price Trend of Crude Oil



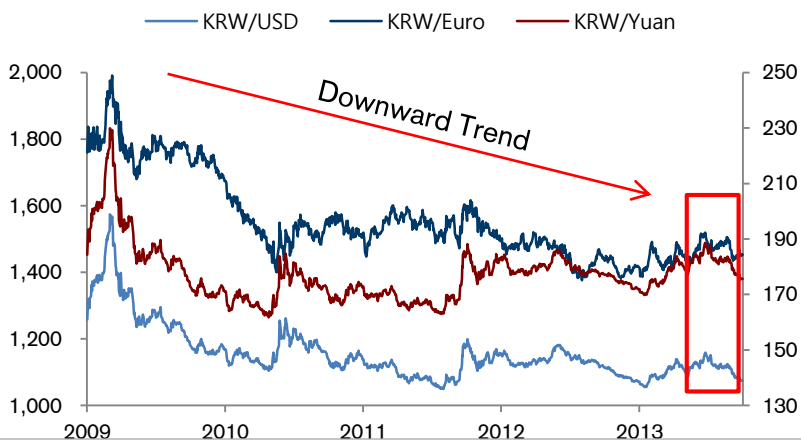
Source: Fenero Research

Price Trend of Naphtha



Source: LG Chem, Fenero Research

Trend of the Foreign Exchange Rate



Source: ECOS, Fenero Research

Related Information

- Prices of crude oil, and Naphtha, are decreasing. They are used to key raw material of LG Chem's products, so this trend will help LG Chem to improve its operating margin
- Looking globally, both short-term and long-term exchange trend show bullish tendency of KRW. It means a favorable factor because the portion of raw materials import in our firm is 100% but the portion of product export in our firm is about 50%.

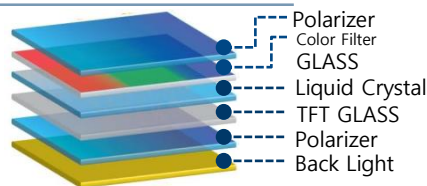
Display(Panel) Industry changes in various forms.

Characteristic and Prospect of Polarizer Industry

Various changes of Display (Panel) Industry

Desktop & Portable Computing

LCD Display



Main Product

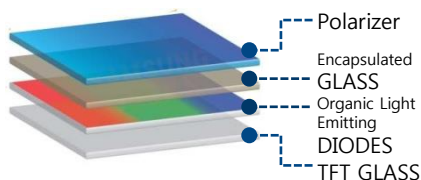


Desktop, Notebook PC

A Personal computer designed to fit on a desk to distinguish office appliances which covered its own area on the floor

Intermediate

OLED Display



Main Product

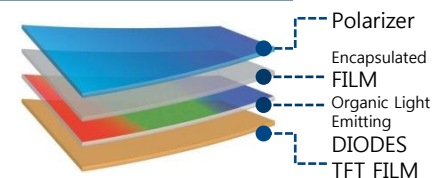


Smartphone

LG Chem. actively manufactured OLED display for smartphone in a wide variety components of efficient ways

Finished goods

Flexible Display



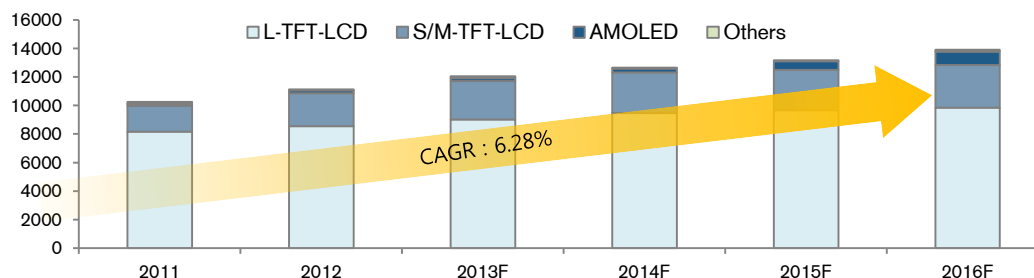
Main Product



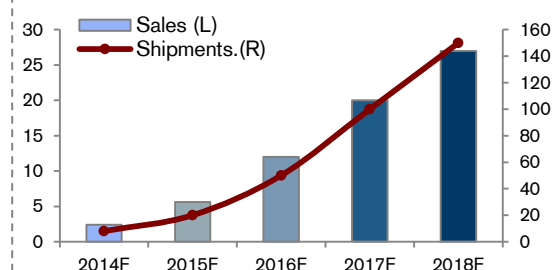
SmartWatch, Smart Glasses

wristwatch or glasses with functionality as comparable to a personal digital assistant device

Growth of 1st / 2nd Generation (Display Panel Market)



Outlook of smart glass market (Sales&Shipments)

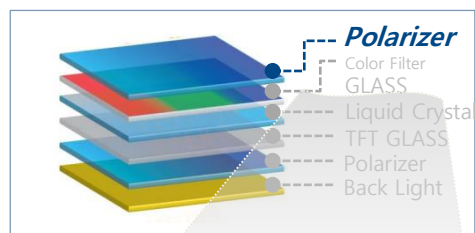


Source: Industry Data, Fenero Research

Sales of RO filter for home use will slightly increase

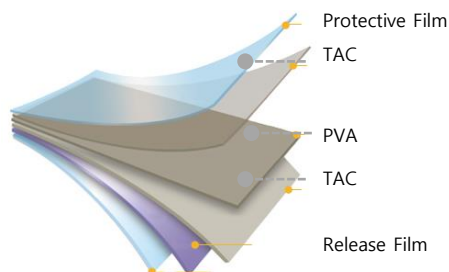
Introduction of Polarizer

Components of TFT-LCD



Understanding of Polarizer

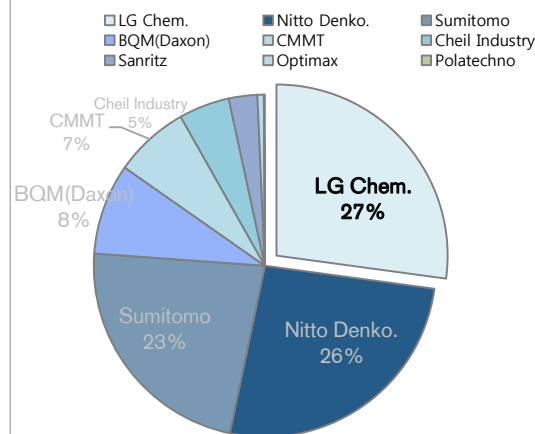
- Polarizer is a multilayered compound film with a thickness of about 300 nanometers. It consists of PVA layer in which iodine materials are oriented, TVC layer that protects PVA, PSA which is an adhesive layer, a protective film, and a release film



- made for other types of electromagnetic waves besides light, such as radio waves, microwaves, and X-rays.,

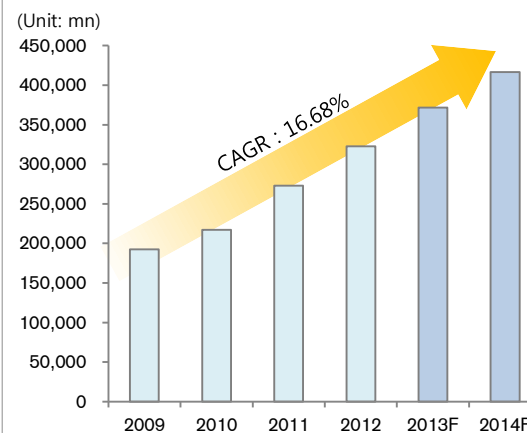
Source: Industry Data, Fenere Research

Global Polarizer Market Share



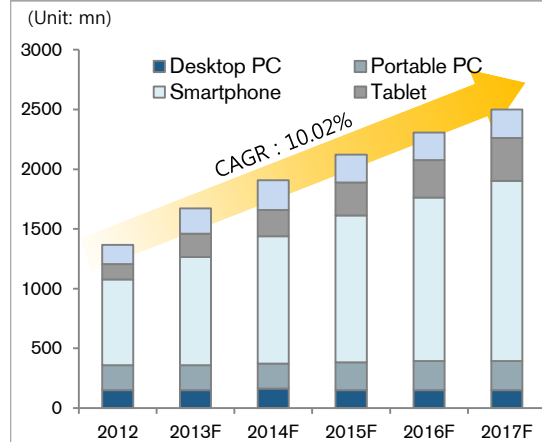
Source: Displaybank, Fenere Research

Growth of Polarizer Market (Demand)



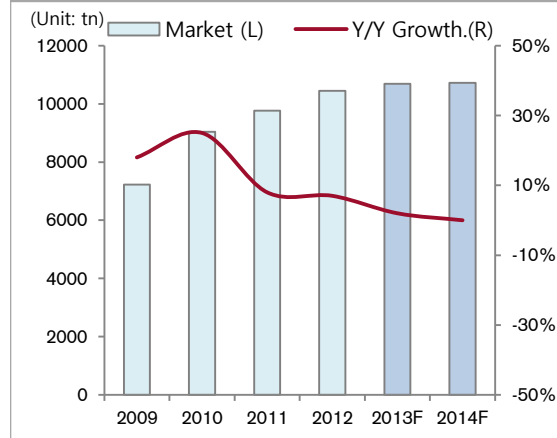
Source: Displaysearch, Fenere Research

Growth of Smart Connected Devices



Source: LG Chem, Fenere Research

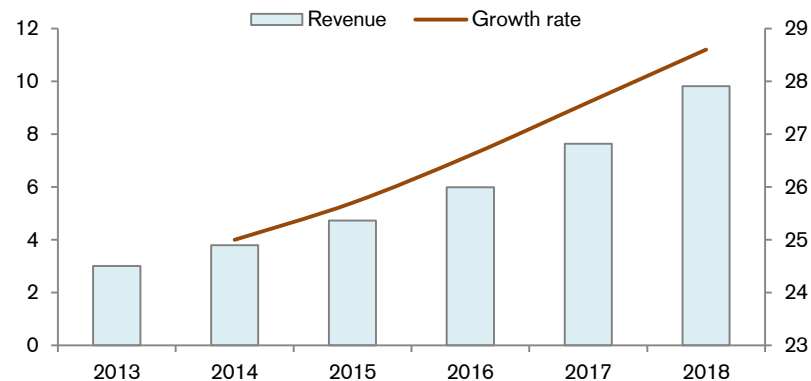
Growth of Polarizer Market (Scale)



Source: Displaysearch, Fenere Research

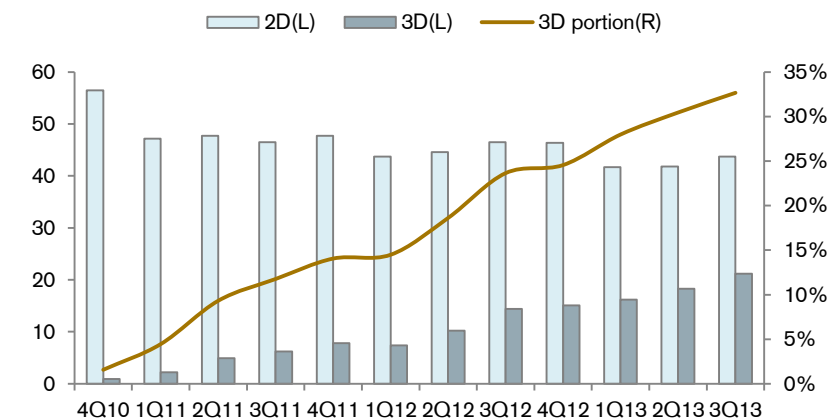
3D TV shipment and penetration grow rapidly

3D Image Market



Source: DisplayCentral

Optical film shipment



Source: Displaysearch

SG(Shutter Glasses) vs FPR(Film-type Patterned Retarder)



SG

- Active 3D
- Field of view: 80 °
- Cannot convert 2D to 3D
- Constant shuttering
- Glasses: 40g, with a battery
expensive
- Detailed image
- SAMSUNG, SONY(30%)
Hisense

FPR

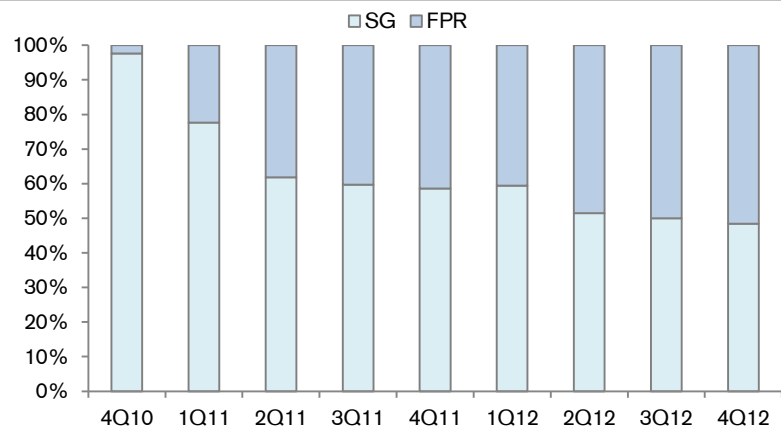
- Passive 3D
- Field of view: 180 °
- Freely convert 2D to 3D
- No shuttering
- Glasses: 18g
reasonable
- Less precision
- LG, SONY(70%)
Panasonic



Source: Fenero Research

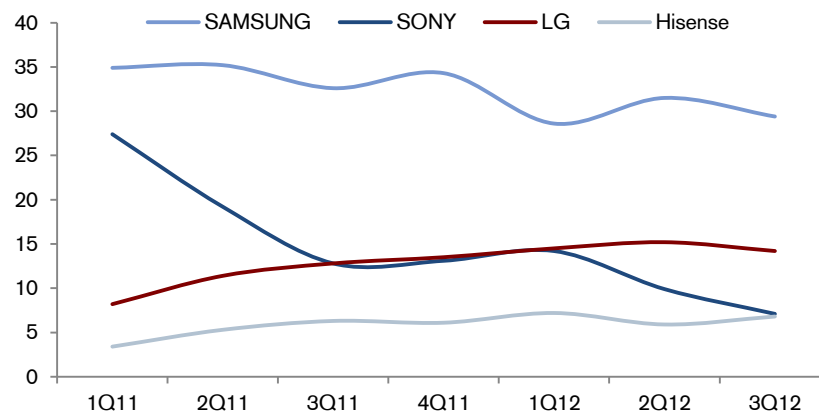
LG Chem's 3D FPR sales will rise as demand for 3D FPR continuously increases

3D TV panel shipment portion



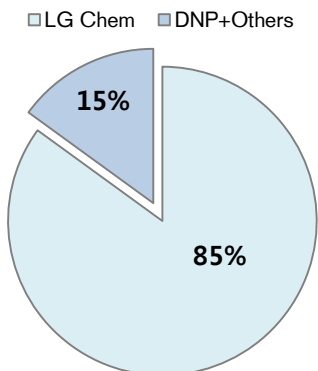
Source: Displaysearch

Global 3D TV Market share of TOP 4 companies



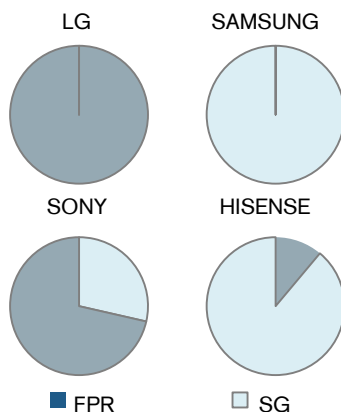
Source: Displaysearch

FPR Film market in 2012



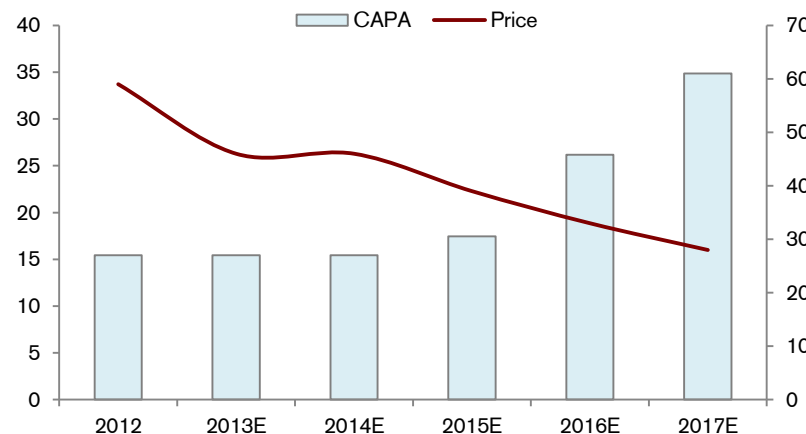
Source: Displaybank

3D implement of firms



Source: Fenero Research

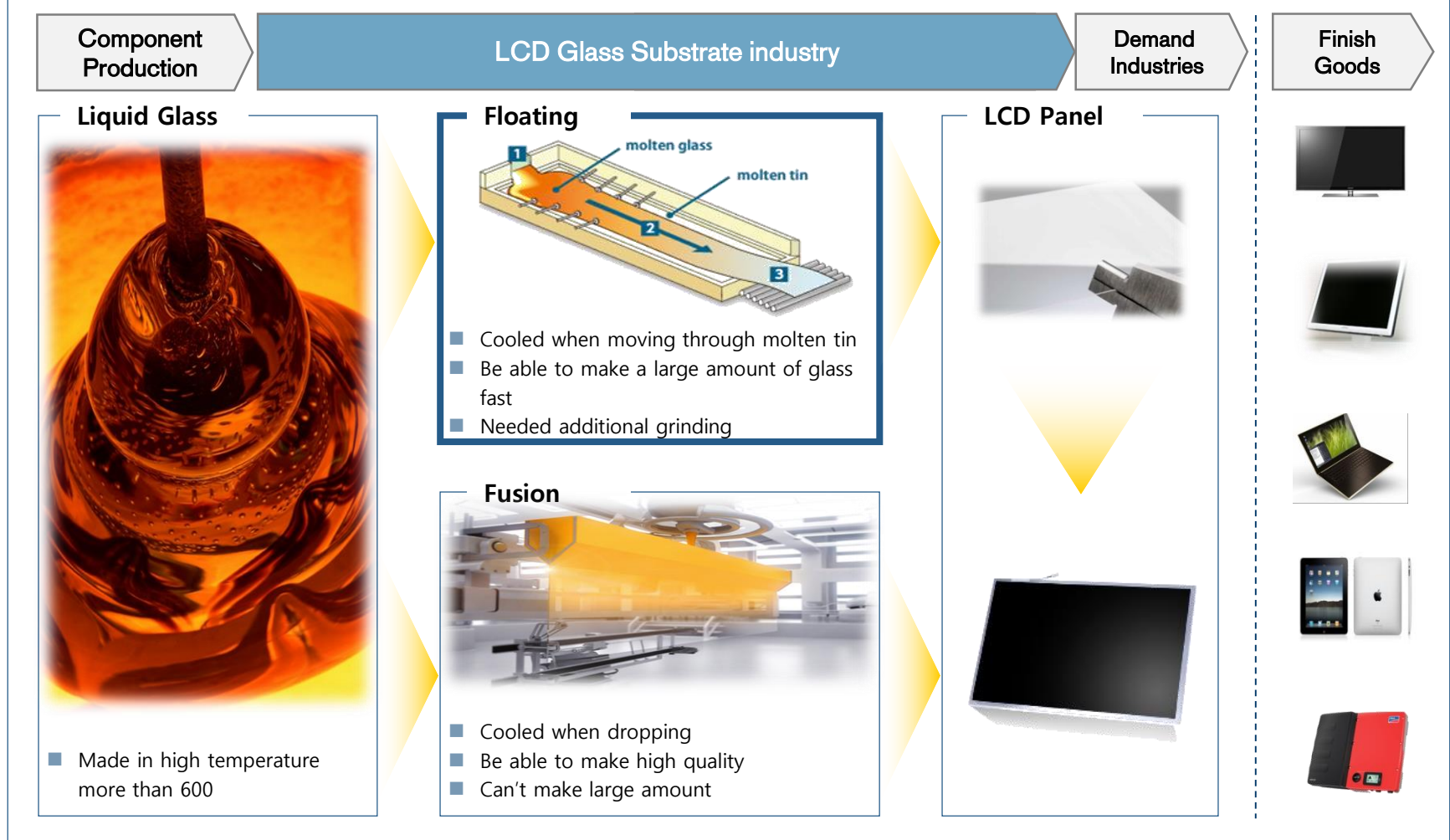
CAPA and unit price of LG 3D FPR Film



Source: HANA Research

“Floating” is appropriate for mass production

Process of forming LCD Glass Substrate



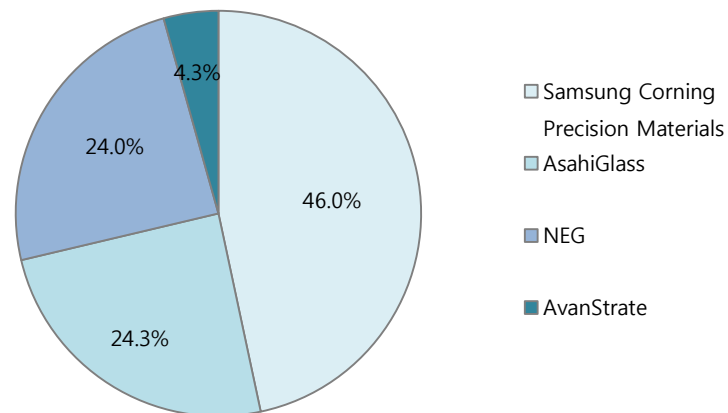
Demand of LCD Glass Substrate is Stable, and the market looks like oligopoly

Market Size & Growth Rate



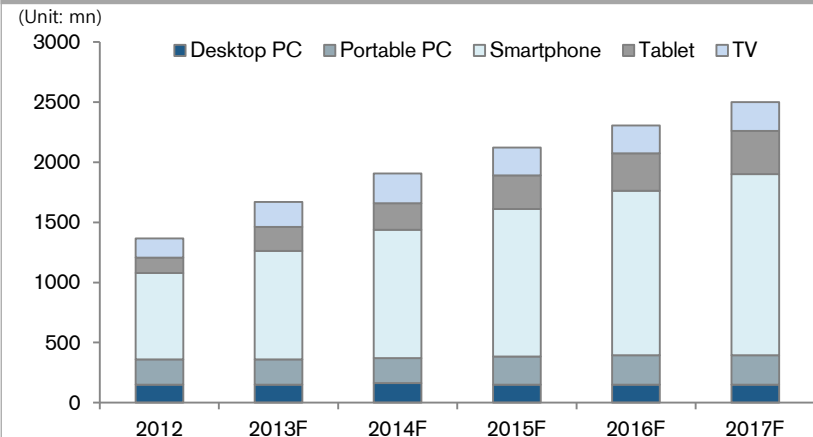
Source: Displaysearch, Fenero Research

Market Share



Source: Displaysearch, Fenero Research

Devices Containing LCD Glass Substrate Market size



Source: Industry Data, Fenero Research

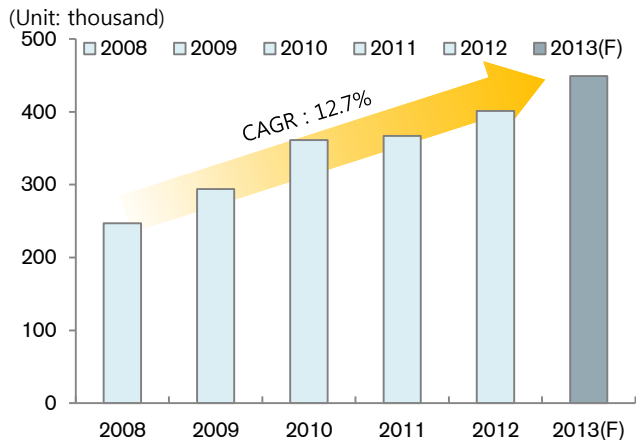
Related Information

- Even though the growth rate of LCD glass substrate is slightly decreasing, the market size is still increasing and TV, tablet PC, smart phone, monitor is constantly used. Therefore, the demand of LCD glass substrate will be stable.
- Due to the oligopoly of market, operating profit ratio is very high. The average of operating profit ratio of 4 main companies is more than 40%. Once the firm enters the market, it will report high profit ratio.
- The Market size of TV, PC, smartphone, tablet that contain LCD glass substrate gets bigger and bigger. It also proves that the market size of LCD glass substrate will be larger.

Source: LG Chem, Fenero Research

LG Chem will be affiliated with big 4 companies of LCD Glass Substrate industry until 2016

LG Display Shipment

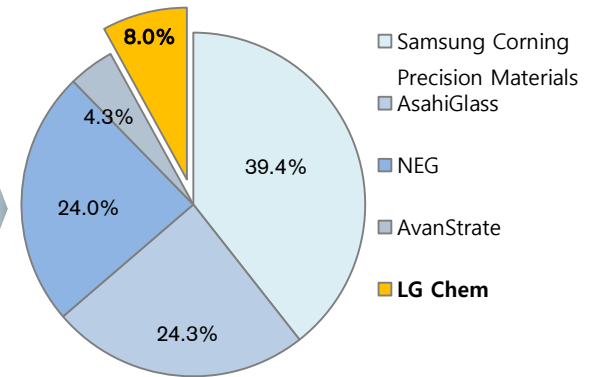


Source: Hana Daetoo Securities, Fenero Research

Assumption of Market Share

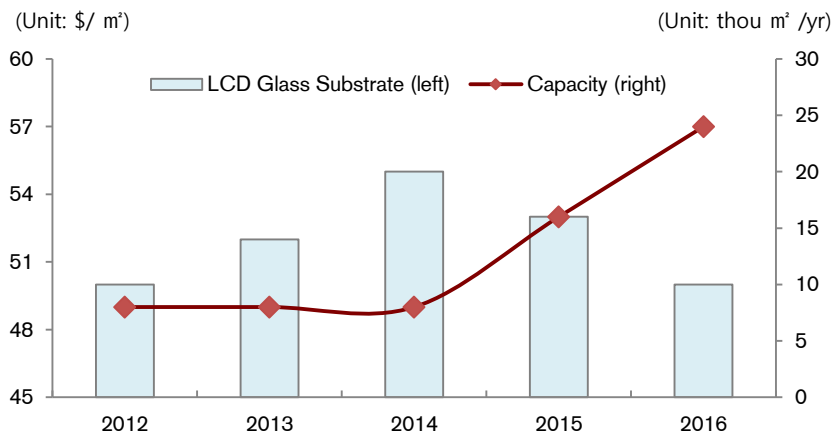
SCHOTT
glass made of ideas
■ Used its own technology that is different from competing companies

LG Chem
■ Invested 430 Bil KRW in 2013, and will totally invest 1,200 Bil KRW to 2015



Source: Displaysearch, Fenero Research

Price Assumption & Capacity



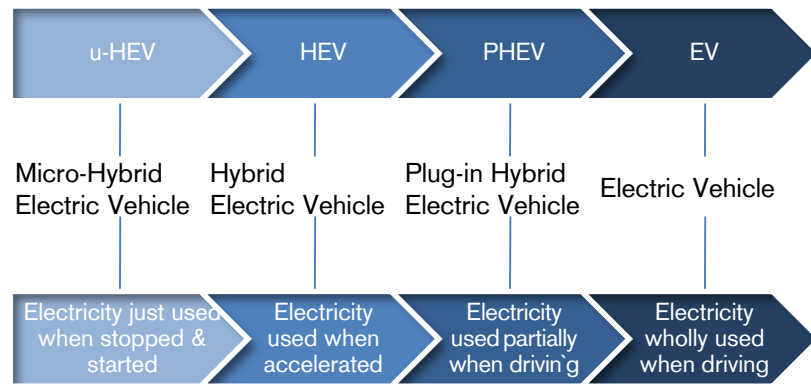
Source: Hana Daetoo Securities, Fenero Research

Related Information

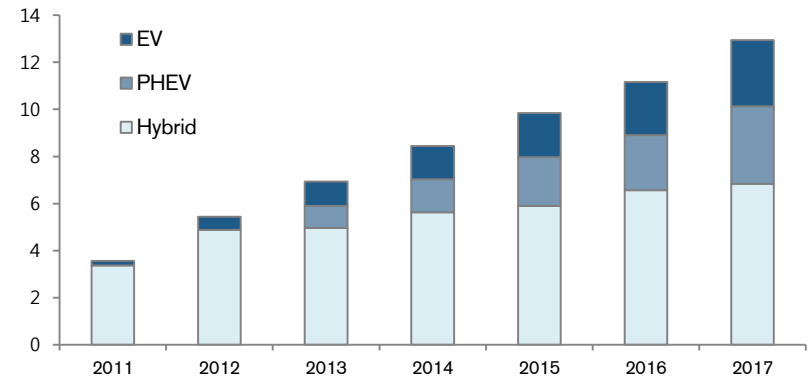
- After LG Chem jump into the LCD glass substrate industry, if the product line operates fully, the firm can share 8% of whole market. More precisely, it will take market share from Samsung Corning Precision Materials because previously LG Display took the LCD glass substrate from Samsung Corning Precision Materials.
- If LG Chem started its LCD glass substrate, the vertical integration is made from LG Chem and LG Display to LG Electronics. Therefore, the competitiveness of the firm will be stronger.
- At first the price of LCD glass substrate will be more expensive, but under the influence of augmented capacity and adaptation in the industry the price will decrease started from 2014.

The portion of secondary battery becomes larger when progressing hybrid vehicle to EV

Process of Progress to EV



Prospect of xEV Market

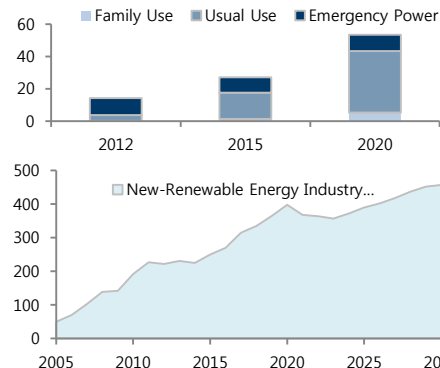


Source: J.D Power

ESS(Energy Storage System) industry in long-term view

The concept of ESS and renewable energy industry

- ESS(Energy Storage System) is the system that can store a lot of electricity
- Renewable Energy such as solar energy and wind energy can generate but can not store electricity by itself.
- In this condition, LIB can be a good alternative



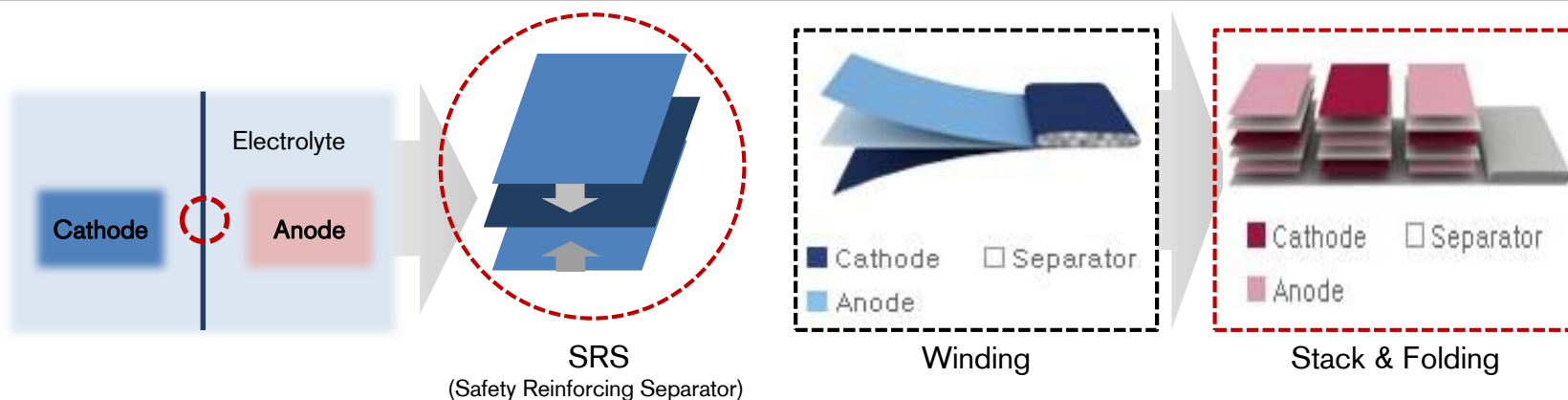
Source: LG ERI, New Energy Finance

The Growth of Notebook and Tablet PC Market

- LIB can be used to store new-renewable energies long-time without little losses of electricity.
- Every year there has been more and more electric shortage in summer. Until now, we solve this problem by generating nuclear power plants, but recently a big nuclear plant was collapsed in Japan.
- In this situation, the nuclear energy will not be the solution forever. Therefore, the future solution is ESS. Even though this can't give us profit right now, but we need to take care this industry at the point of long-term view. It will give us revenue in the future.

Various shapes of high-capacity battery solutions enhance the flexibility of device design

Technological priorities of LG Chemical



Source: Industry Data, Fenero Research

World's first flexible battery in 2013

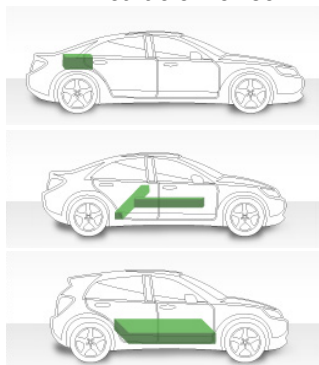
Wearable Device



Flexible Device

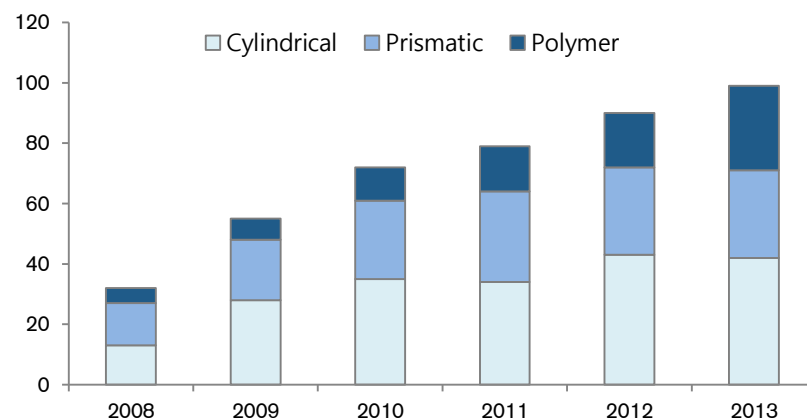


Wearable Device



Source: Fenero Research

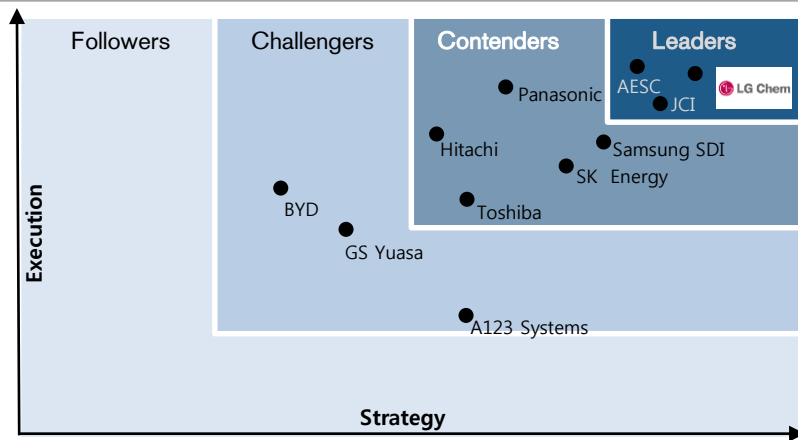
LG Chem's producing capacity of portable batteries



Source: Industry Data, Fenero Research

Global leader of EV battery market

Leader-board of EV battery industry



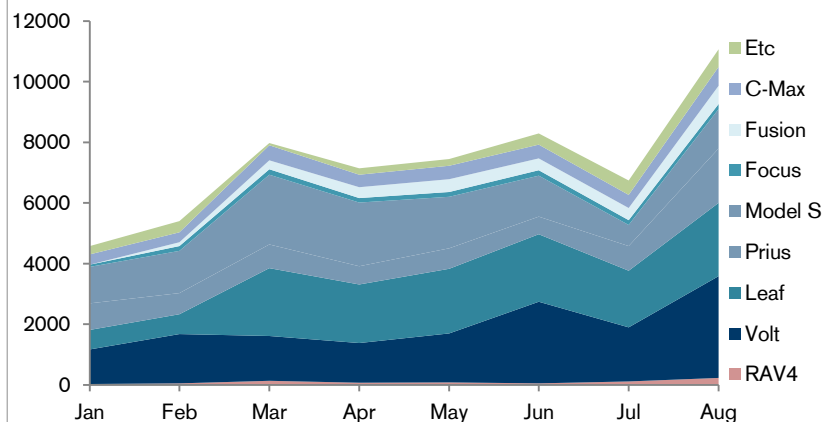
Source: Navigant Research

EV equipped with LG Chem's rechargeable batteries



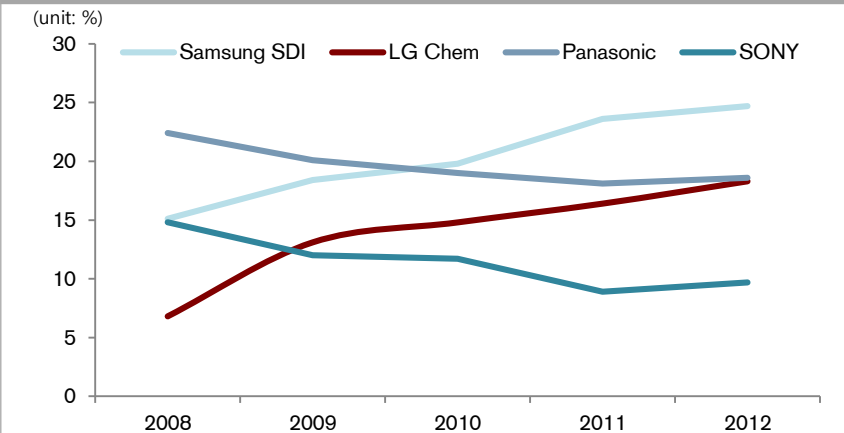
Source: LG Chem

US monthly EV sales volume in 2013



Source: Fenero Research

Market share of top four battery makers



Source: IIT

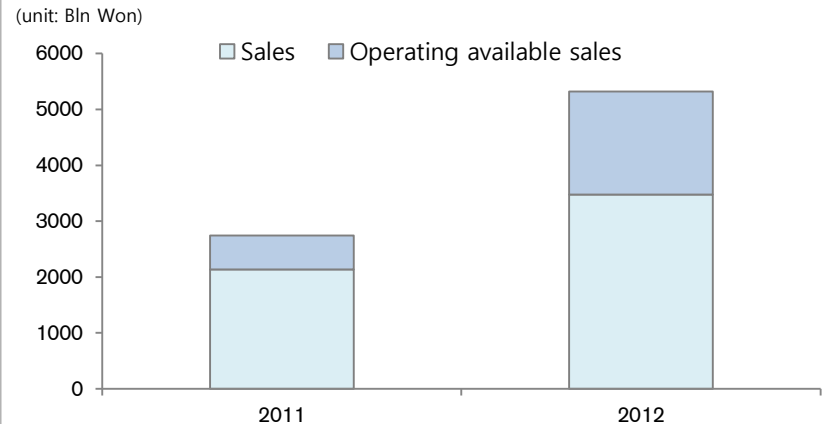
Global leader of EV battery market

Growing establish and investment in LIB production



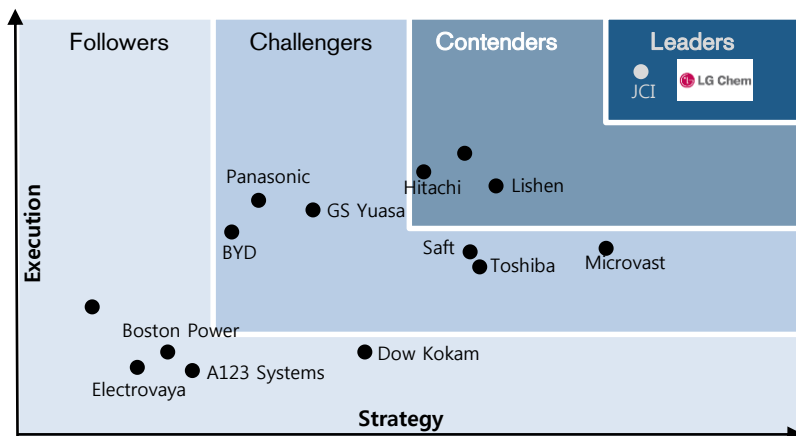
Source: Company Data, Fenero Research

LG Chem's LIB operating available sales



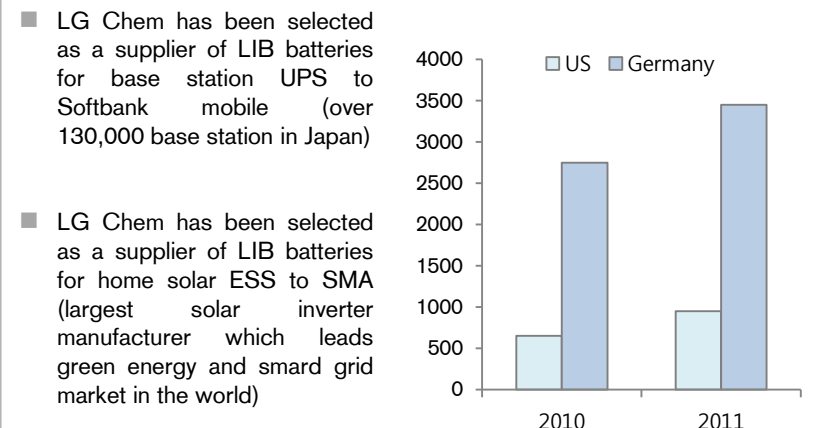
Source: DART

Leader-board of ESS battery producing companies



Source: Navigant Research

Germany Energy production



Source: LG Chem, GTM/SEIA, Federal Grid Agency

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