

*"For more than 165 years, Corning has applied its unparalleled expertise in specialty glass, ceramics, and optical physics to develop products that have created new industries and transformed people's lives"* 

Current Price: \$30.05 Price Target: \$35.68

Long Thesis of Corning (NYSE: GLW) by Jake Gutwein

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# I: Company Overview

"Corning Incorporated is a global technology-based company. The Company produces optical fiber, cable, and photonic components for the telecommunications industry, as well as manufactures glass panels, funnels, liquid crystal display glass, and projection video lens assemblies for the information display industry."

## **Financial Metrics & Ratios**

Share Price: \$30.05 52-Week Range: \$22.23-\$32.17 Beta: 1.191 Market Cap: \$27,140.7M P/E: 17.73x EV/EBITDA: 10.0x PEG: 2.07x Net Debt/EBITDA: -0.54x Debt: \$3,646M Current Ratio: 3.29x Dividend Yield: 1.8-2.3% Gross Margin: 39.89%

### **Company Information & Themes**

**Business Segments:** Corning separates their operations into five distinct business segments: Display Technologies, Optical Communications, Specialty Materials, Environmental Technologies, Life Sciences

**Stability & Growth:** Corning has products and inputs in several verticals that are mature and have seen growth plateau, though many sectors provide unique opportunities for strong upside growth

**Company Founding:** The company was founded by Amory Houghton in 1851 and initially invested in the creation of glass

**Joint Ventures:** Corning has an extensive history of joint ventures, including Owens Corning Fiberglass, Dow Corning, Siemens, and Genentech

**Innovation:** The company has a strong history and culture of innovation, which is reflected in their R&D allocation, and is at the forefront of new developments in many of the end markets that they serve

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The company is headquartered in Corning, NY

"Corning Incorporated is a global technology-based company. The Company produces optical fiber, cable, and photonic components for the telecommunications industry, as well as manufactures glass panels, funnels, liquid crystal display glass, and projection video lens assemblies for the information display industry."



## Management Team



**Wendell Weeks,** *Chairman & CEO*: Joined Corning in 1983 and has been a member of the board since 2000. Weeks took the role of CEO in 2005 and Chairman in 2007, and also is on the boards of Merck and Amazon. He received a MBA from Harvard University.



**Lawrence McRae,** *Vice Chairman & Corporate Development Officer*: Joined Corning in 1985 and has worked in a variety of areas of the business. McRae joined the management committee in 2002 and took his current role in 2015. He received a Master's degree from Harvard University.



**Martin Curran,** *Executive Vice President & Corning Innovation Officer*: Joined Corning in 1984 and has worked throughout the company in several roles. Curran became the first innovation officer in 2012 and supports new business opportunities. He received a MBA from the University of Virginia.



**Dr. Jeffrey Evenson,** *Senior Vice President & Chief Strategy Officer*: Joined Corning in 2011 and the role in 2015. Before Corning, Evenson worked for Sanford C. Bernstein and was a partner for McKinsey & Company. He received a PhD in Physics from Harvard University. Common Theme: Management is well-versed in Corning's operations with decades of experience





COLUMBIA UNIVERSITY Sources: Thomson One IN THE CITY OF NEW YORK

## **Business Segment Descriptions**

**Display Technologies:** "Manufactures glass substrates for liquid crystal displays ("LCDs") that are used primarily in LCD televisions, notebook computers and flat panel desktop monitors."

**Optical Communications:** Develops "products and solutions for optical-based communications infrastructure for services such as video, data and voice communications." Also develops "optical-based communication networks sold to businesses, governments and individuals for their own use."

**Specialty Materials:** "The Specialty Materials segment manufactures products that provide more than 150 material formulations for glass, glass ceramics and fluoride crystals."

**Environmental Technologies:** "Manufactures ceramic substrates and filter products for emissions control in mobile and stationary applications."

**Life Sciences:** "Collaborates with researchers and drug manufacturers seeking new approaches to increase efficiencies, reduce costs and compress timeline."



## Revenue by Segment and Geography

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COLUMBIA UNIVERSITY Sources: Corning 2016 10K IN THE CITY OF NEW YORK

# Revenue & Net Income by Segment



Net Income by Segment



	<b>Revenue</b> and	Net Income by	Segment	
Display Technolo	ogies	2014	2015	2016
Revenue		3851	3086	3238
Net Income		935	1095	1396
	% margin	24.28%	35.48%	43.11%
Optical Commun	ications	2014	2015	2016
Revenue		2652	2980	3005
Net Income		245	237	194
	% margin	9.24%	7.95%	6.46%
Invironmental T	echnologies	2014	2015	2016
Revenue		1092	1053	1032
Net Income		133	161	178
	% margin	12.18%	15.29%	17.25%
pecialty Materi	als	2014	2015	2016
Revenue		1205	1107	1124
Net Income		174	167	138
	% margin	14.44%	15.09%	12.28%
ife Sciences		2014	2015	2016
Revenue		862	821	839
Net Income		58	62	67
	% margin	6.73%	7.55%	7.99%
Other		2014	2015	2016
Revenue		53	64	152
Net Income		-240	-202	-198
	% margin	-452.83%	-315.63%	-130.26%

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# **Display Technologies**

## Segment Outlook

- Increasing average TV sizes could result in heightened volume, as "every 1" increase in screen size may drive a 5-6% increase in glass area demand"
- Margins are projected stabilize as competition reaches a plateau
- Corning believes that OLED will only impact small devices; potential to capture growth in flexible OLED segment through substrates
- Corning is attempting to break into both the exterior and interior auto glass market, focusing on premium products - currently in 20 models
- Analysts project approximately 1% growth through 2017



Application of Corning's EAGLE XG substrate - curved TV panels

## **Segment Description & Analysis**

- The Display Technologies portion of Corning's business is most well-known for glass substrates that are used in LCD screens for televisions, laptops, and monitors
- Substrates are created using a proprietary fusion method that results in increased automation, scalability, and cost-effectiveness
- Customers that use Corning can economically create displays that are "larger, lighter, thinner, and higher-resolution" which could result in enhanced margins and customer savings
- Samsung Corning Precision Materials Co., previously an equity venture between the two companies with Corning owning 57.5%, was acquired by Corning in 2014 and enabled access to \$1.2 billion in cash on the venture's balance sheet
- Corning's LCD manufacturing facilities are located in China, Japan, Taiwan, and South Korea, which accounted for 44.4% of computer device exports in 2016 and are some of the largest producers of products that require Corning's inputs

"Better supply/demand alignment...continued profitability challenges of competitors, and need for more advanced glass" serve as tailwinds for increased profitability

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# **Optical Communications**

## Segment Outlook

- Increasing video usage, which causes an upsurge in bandwidth demand, has led telecommunications networks to increase adoption of optical-based systems
- Fiber-rich architectures, which necessitates increased expenditure by bringing fiber closer to customers, is expected to prompt double-digit growth
- Tailwinds, such as 5G, FTTH investment, copper to fiber conversion, and data center investment will aid in overall revenue growth
- Projections indicate that this segment will grow to \$5B in 2020 from \$3.6B in 2016; growth will be both organic and through acquisition



Corning's ClearCurve O ultra-bendable multimode fiber

## **Segment Description & Analysis**

- Corning first developed fiber optics technology in the mid-1960's and were ready to deploy by 1970 but AT&T, which was the only potential customer at the time, said it would be thirty years before they would incorporate optical solutions
- Corning has the unique ability to provide an entire suite of solutions to telecommunications companies which differentiates them from competitors
- The company then decided to create a joint venture with Siemens to facilitate the acceleration of optical fiber cable adoption
- This business segment is further divided into the carrier network and enterprise network; hyperscale data centers account for approximately 30% of segment revenues
- The carrier network serves the communications infrastructure market for services including video, data, and voice
- The enterprise network provides communications networks to businesses, governments, and individuals
- Corning produces distributed antenna systems (DAS) which help account for high bandwidth demand in targeted locations

"Our experience puts us in a unique position to design and deliver optical solutions that reach every edge of the communications network"



# **Environmental Technologies**

## Segment Outlook

- Europe and China have increased legislation surrounding gasoline engines, directly impacting demand for Corning's particulate filters
- Few gasoline direct engine vehicles currently use particulate filters which likely will be mandated by regulations, increasing TAM by 3-4x/vehicle
- Since 2016, Corning has been built into 50 vehicle designs which will positively impact long-term revenue
- Uncertainty surrounding the automotive market's stability increases segment risk as sales can be highly cyclical
- Management is projecting \$50-100M in new revenues in 2018 and growth in later years

## **Segment Description & Analysis**

- The segment serves the emissions control market and produces a variety of ceramic substrates and filter solutions
- Sales in this segment are primarily to the emissions control systems manufacturers who then sell the completed systems to the automotive engine manufacturers
- Regulations have served as a tailwind for Corning, and often the substrates and filters produced by the company are required by legislation
- Corning's environmental technologies products are manufactured in New York, Virginia, China, Germany, and South Africa
- In addition to Corning's own patents, they are licensed to use additional patents from different owners which are important to the segment
- Electric vehicles will have a minimized need for particulate filters, but hybrid vehicles will maintain demand for this business segment



Corning's Ceramic Particulate Filters

"As global emissions control regulations tighten, Corning has continued to develop more effective and durable ceramic substrate and filter products for gasoline and diesel applications"

# **Specialty Materials**

## Segment Outlook

- High-end devices that are double-sided expand the TAM for Gorilla Glass, and Samsung, Apple, and LG all have double-sided devices
- Gorilla Glass could also serve the automotive market, though analysts are uncertain as to the timing of when revenue would be impacted
- There is potential for Corning to offer Gorilla Glass with higher value generation, leading to increased margins and defensibility
- Gorilla Glass currently has 7x the market of their largest competitor, which helps the technology succeed in breaking into additional markets

## **Segment Description & Analysis**

- The segment currently manufactures over 150 formulations of materials that are for glass, glass ceramics, and fluoride crystals
- End markets include display optics & components, aerospace & defense, astronomy, telecommunications, and portable device glass
- Gorilla Glass the largest product in this segment is used as the display glass for portable devices including Samsung, Sony, and Motorola
- Gorilla Glass is manufactured in Kentucky, South Korea, Japan, and Taiwan, which enables them to be close to their customers
- Gorilla Glass 5 was released in 2016 and provided stronger glass with increased sensitivity capabilities
- Glass lens and window assemblies are also included in this segment, diversifying it from the consumer electronics market



Advertisement for Corning's Gorilla Glass "Corning's specialty materials business primarily focuses on the sale of Gorilla Glass into the smartphone market where the company's technology has been adopted by more than 40 brands"

# Life Sciences

## Segment Outlook

- Glass vials that are used to deliver products have to be approved for each individual drug, enabling analysts to project revenue impacts
- Advanced packaging is becoming a larger trend, expecting to be a \$12B opportunity for Corning
- Corning projects that the vessel side of the business will increase at twice the rate of the lab consumables portion

Corning estimates that the life sciences markets that they impact are growing at 6% y/y

## **Segment Description & Analysis**

- This segment works with key stakeholders in the drug manufacturing process to create unique solutions
- Corning's strong customer relationships in this segment help defensibility, as they are able to work closely with companies and hear what is desired bringing them closer to their customers than many of their competitors
- Corning initially invested  $500\mbox{M}$  in Valor glass, which has a potential  $4\mbox{B}$  market opportunity
- The company expects \$1 of annual sales for every dollar of investment
- Corning is #2 in the life sciences vessel market for laboratories, and is also top of liquid handling, cell culture, and adherent cell bioprocessing



Corning's Valor Glass is expected to increase Life Science Revenue

"As a leading developer, manufacturer and global supplier of scientific laboratory products for 100 years, Corning's Life Sciences segment collaborates with researchers and drug manufacturers seeking new approaches to increase efficiencies, reduce costs and compress timelines"

## **Capital Return Program**

- The management team is focused on a capital return program that aims to return over \$12.5B via share repurchases and dividends

- The company has already returned \$7.4B since October 2015, reducing outstanding shares by 26% and increasing the dividend 12.5% and 14.8% in consecutive years

- Dividend increases are projected to continue increasing at a minimum of 10% in 2018 and 2019

- Corning will continue to support long-term growth by investing \$10B in new developments

- Divestiture of ownership in the Dow Corning joint venture provides Corning with flexibility in the capital return program, with only \$2.5B of the \$4.8B received currently committed

- Additional revenue could end up being used in the capital return program, potentially increasing shareholder returns

## **Unique Capabilities**

- The management team has shown that they are able to exercise expense discipline, illustrated by their reduction of display segment costs by 10% in 2015 in response to reduced sales

- Strong partnerships with customers has enabled the reduction of capital expenditures for new plant construction, shown by the fact that over \$1B of the total \$1.3B needed for a new Hefei plant was contributed by key customers

- Apple distributed \$200M via their Advanced Manufacturing Fund to Corning, which benefits R&D, glass processing, and capital equipment

- Verizon recently partnered with Corning, resulting in at least \$1B in optical demand through 2020

- Merck & Pfizer have both committed to collaborate with Corning to increase R&D and build the life sciences division

- Acquisitions have often been accretive historically, and could continue impacting the bottom-line if further investments are made

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# **Executive Compensation**

## Short-Term/Annual Incentives

## **Performance Incentive Plan**

- *Core EPS (75%)*: In 2016, the performance target was an EPS of \$1.55 which was achieved by the management team, receiving 100% of the targeted payout
- Core Net Sales (25%): In 2016, the performance target was \$9,996M in net sales which was greater than the achieved net sales of \$9,710M. This accounted for 38% of the targeted payout
- Blended payout was 85% of the targeted payout for 2016

## GoalSharing

- Weighted Average of Business Unit Plans: The performance target for this segment is based on the average of business unit plans. In 2016, the management team exceeded the performance target which accounted for 5.96% of base salary versus the target of 5%

## Long-Term Incentives

## Cash Performance Units (60%)

- *Adjusted Operating Cash Flow (70%)*: Payout is contingent upon a three-year program (i.e. 2016-2018). In 2016, payout was 100% of the targeted payout.

- Core Net Sales (30%): In 2016, the performance target was \$9,996M in net sales which was greater than the achieved net sales of \$9,710M. This accounted for 38% of the targeted payout

## **Equity Incentives (40%)**

- RSUs (25%): Granted RSUs are based on the end of March share price
- Options (15%): Quantity is determined using the Black-Scholes valuation and have a maximum of a 10-year term

## **Additional Notes**

- The executive compensation program uses a range for EPS, Net Sales, and Cash Flow (detailed in the appendix) which allows the management team to receive portions of benefits if they are able to reach different target metrics

- Corning's SVP of Human Resources and SVP of Global Compensation and Benefits collaborate with the HR, Law, and Finance departments to design and implement executive compensation programs



# "Moat" Analysis

## **Patent Portfolio**

- In 2016 alone the company was granted approximately 460 US patents and 1100 non-US patents

- Approximately 6% of patents will expire between 2017 and 2019, though certain patents are more important than others to their operations

- The company has around 10,500 patent applications in process, 2,500 of which are US-based and approximately 8,000 which are non-US

- The majority of Corning's patents are either licensed to others, used in Corning's operations, or are licensed to use patents owned by others; cross-licensing relationships exist with some major competitors

## **R&D** Capabilities & Emphasis

- Even during the difficult years of 2000 and 2002, Corning's management team continued to spend on innovation despite falling bottom-lines

- "We succeed through sustained investment in research and development, a unique combination of material and process innovation, and close collaboration with customers to solve tough technology challenges"

- Historical R&D/Revenue ratio has been at 9% and is expected to fluctuate between 7-9% in the next few years

- The size of Corning relative to their peer group allows management to confidently invest a larger amount in R&D, supporting long-term growth



# **II: Industry Overview**

## **Key Industry Growth Rates**





## Fiber-Optic Cable Industry Dynamics

- Broadband demand is expected to continue experiencing growth over the next five years, growing at approximately 5.2% annually through 2021

- Adoption of fiber-optic cables is encouraged by increased content demand, as fiber-optic cables have data-carrying capacity that is thousands of times higher than copper

- The US market is facing increased competition from suppliers located in Mexico and China which have lower production costs

- Exports represent 35.3% of industry revenue with projected growth rates of 5.9% through 2021; Europe and Japan will demand additional cable to supplement their supply

- Wireless providers are increasing their size and scope of their networks to meet heightened demand for high-speed internet on mobile devices

- Certain providers have increased their expenditure faster than others, leading to projected increased capital expenditure on behalf of competitors

- Providers usually source from companies that they have strong relationships with already

### **Fiber-Optic Cable Competitors**

**AFL Telecommunications** (21.7% market share): "South Carolina-based manufacturer of **fiber-optic products and equipment**, with operations throughout the United States, Mexico, Europe and Asia. In 2005, AFL became a wholly owned subsidiary of Fujikura Ltd., a Japanese corporation. The company employs about 2,600 people and primarily serves the utility, broadband communications and enterprise markets."

**Optical Fiber Solutions** (16.7% market share): "Georgia-based optic fiber and cable manufacturer. The company, which can trace its roots back to the Western Electric Company, became a wholly owned subsidiary of Japanese-owned Furukawa Electric Company in 2004. OFS has facilities throughout the United States, Denmark, Germany and Russia. The company employs about 500 people total. The company's operating segments include: **optical cable, optical connectivity, optical fiber, fiber to the home, and laboratory**."

**Optical Cable Corporation** (1.9% market share): "Leading manufacturer of a broad range of fiber-optic and copper data communication cabling and connectivity solutions primarily for the enterprise market. Headquartered in Roanoke, VA, the company was established in 1983 and has grown to encompass manufacturing and warehouse facilities located across three states."

# **Glass Product Manufacturing**

## **Glass Product Manufacturing Industry Dynamics**

- Imports are impacting the US market as reduced production prices overseas allow certain companies to compete on a price basis

- Glass containers are beginning to replace plastic products in the container market
- Export growth is also expected to be strong over the next few years
- US-manufactured purchased glass, which is used in construction, durable goods, and automobiles
- Exports are projected to increase at 1.5% for the next five years (through 2022)

## **Glass Product Manufacturing Competitors**

**Ardagh Group SA** (5.5% market share): "Ardagh Group SA is a global supplier of glass and metal packaging, with 109 facilities and 23,500 employees in 22 countries. Ardagh's metal group produces packaging for food, seafood, paints and coatings, as well as aerosols. Its glass group, which is relevant to this industry, primarily focuses on the **food and beverage market**, producing packaging for beers, ciders, foods, wines, pharmaceuticals and spirits."

**Cardinal Glass Industries Inc.** (1.8% market share): "Privately owned Cardinal Glass Industries Inc. was founded in Minneapolis, MN in 1962. Cardinal Glass is a corporation with six wholly-owned subsidiaries: Cardinal IG Company (insulating glass), Cardinal CG Company (coated glass and optical mirrors), Cardinal LG Company (laminated glass), Cardinal FG Company (float and tempered glass), Cardinal ST Company (solar technology) and Cardinal AG (automotive glass). Cardinal Glass clients operate primarily in the **residential construction market**. More recently, the company has targeted renewable energy clients."

Asahi Glass Company Ltd. (1.7% market share): "Asahi Glass Company Limited (AGC) manufactures flat glass, automotive glass, display glass for electronics and glass for the solar energy industry. AGC's flat glass products include sheet glass, figured glass for construction, mirrors and industrial glasses. Its automotive glass products include laminated and tempered glass for automobiles, while its display glass products include flat panel displays. However, AGC does not manufacture glass substrates, LCD and display glass products in the United States.

# TV, DVD, and Video Equipment Manufacturing

## TV, DVD, and Video Equipment Manufacturing Industry Dynamics

- The industry is projected to grow at a slower rate over the next five years (through 2022)

- Pricing for products will decrease in the coming years as input prices are expected to decrease at scale

- Revenue is expected to decrease in the coming years as fewer electronics products are demanded and total electronics stabilize

- Demand growth is expected to increase in emerging markets

- Profit margins in the industry are expected to decrease as a result of increased competition

- Color televisions in the Chinese urban market is approximately 138.1 units per 100 households

- Production capacity in China is expected to grow 40% between 2010 and 2018 accounting for 35% of the global market

#### TV, DVD, and Video Equipment Manufacturing Competitors

**Hisense Group** (6.7% market share): "Established in 1994, Hisense Group is one of the largest manufacturers of household appliances in China. It originated from Qingdao Second Wireless Factory, which was established in 1969. Since the 1970s, Qingdao Second Wireless Factory has researched and developed TV technologies. In 1979, the factory changed its name to Qingdao TV Factory, and in 1984 it introduced advanced technologies and equipment from Panasonic."

**TCL Corporation** (6.3% market share): "Incorporated in 1981, TCL Corporation has become one of the largest manufacturers of consumer electronics products in China. It has three listed companies (TCL Corporation, TCL Multimedia Technology and TCL Communication Technology) and 25 subsidiaries in China. Most of its TV business is managed by TCL Multimedia Technology, which has a global sales network. The main products TCL Corporation manufactures include **TVs**, **refrigerators, air conditioners, mobile phones, semiconductor chips and displays**, etc. There are three TCL TV brands sold in global markets including TCL, Thomson and RCA."

**Skyworth Group** (5.4% market share): "Skyworth Group was established in 1988, built around Skyworth Digital Holdings Ltd., and listed on the Hong Kong Stock Exchange in 2000. It has 42 subsidiaries, 190 offices and 20,000 agents across China. Its main products include **plasma TVs, LCD TVs, CRT TVs and mobile phones**. There are four TV production bases, which are located in Shenzhen Gongming, Shenzhen Shiyan, Guangzhou and Inner Mongolia."

# III: Thesis & Catalysts

The market is undervaluing Corning's R&D capabilities which could result in positive revenue impacts beyond current estimations and earlier than what analysts are projecting

- Coverage is aware that Corning has strong R&D, but is uncertain as to when it will materially impact the bottom-line
- The impacts could lead to increased spending on new product development, accelerated capital return through share repurchases and/or increased dividends, or improved margins
- Current analyst expectations are hesitant to price in the impacts of R&D programs that have shown signs of paying off soon due to uncertainty surrounding the timeline of these impacts
- Patents provide insulation from competition and help protect the company from excessive margin reductions
- Corning should trade at a premium to their competitors as a result of the defensibility created by patents and heavy R&D spending moving forward



# Automotive & Life Sciences Market

## **Automotive Trends**

- Recently expanded production capabilities of gas particulate filters which resulted from capital expenditures in the first half of 2017, which is a response to demand increases from heightened regulations

- Long-term demand for Gorilla Glass is expected to increase as a result of automotive integration, and Corning has already integrated with six high-end cars

- Consumer demand for touchscreen functionality within vehicles could spark increased Gorilla Glass revenue

- Gorilla Glass could also be integrated in exterior windows as well, as it is cheaper, more durable, and lighter than the current glass used

## Life Sciences Trends

- Investment in Valor Glass with key pharmaceutical companies is increasing

- An additional investment of 4B is possible if Corning sees significant revenue potential within the estimated 12B TAM

- The FDA approval process provides advanced vision on potential revenue coming from the segment

- Revenue received would be recurring in nature, increasing margins as a result of certain expenses being spread over the customer lifetime

## Analyst Outlook

- Guggenheim: "longer-term upside optionality in Automotive Gorilla Glass and pharmaceutical Valor Glass"

- Morgan Stanley: "timing is hard to predict"

- Environmental Auto sales are expected to grow 7% in 2017, 11% in 2018, and 11% in 2019

- Environmental Diesel sales are expected to grow -2% in 2017, 0% in 2018, and 3% in 2019

- Gorilla Glass sales are expected to grow 23% in 2017, 8% in 2018, and 7% in 2019

- Life Sciences revenue is expected to grow 3% in 2017, 4% in 2018, and 5% in 2019

- Auto demand is expected to take several years to materialize and initial revenue is projected to be marginal

- Management stated that they believe they are "nearing a breakthrough moment with development partners, and we believe we'll begin to see initial revenue soon"

## The thesis provided could materialize through a few different events:

- Announcement of additional contracts with key Automotive, Life Sciences, or additional customer bases
  - Projected revenue could either be larger or earlier than expected
  - Guidance could appear in calls or earnings reports
- Improved margins resulting from strategic relationships or additional patents that provide enhanced defensibility against competitors
  - Corning's current Gross Margin is 10.61% higher than comparable companies
  - Corning's current EBITDA Margin is 40.83% higher than comparable companies
  - Corning's Operating margin is 3.78% higher than comparable companies
- Accelerated and/or increased capital return program through additional share repurchases and increased dividends
- Increased R&D spending which would perpetuate the cycle of strong ROI shown through historical R&D expenditure



# **IV: Key Risk Factors**

# **Customer Concentration**

## **Risk Factor: Customer Concentration**

- Due to the nature of Corning's operations, customer concentration continues to be a large risk

- If a customer defaults or switches to a different supplier, Corning could see a steep reduction in revenue

- In 2016, the segments had the following customer concentration data:

**Display Technologies:** 65% of sales were from three customers

Optical Communications: 15% of sales were from a single customer

**Environmental Technologies:** 85% of sales were from three customers

Specialty Materials: 56% of sales were from three customers

Life Sciences: 46% of sales were from two customers

- In 2015, the top ten customers accounted for 45% of total sales

### **Mitigation of Risk Factor**

- Customers are often invested in Corning's operations (see "Business Strategy & Capabilities" slide)

- Corning has emphasized working side-by-side with many customers to ensure that they are able to develop solutions that will continue to be demanded in the future

- Diversifying the customer base is still a key issue that will need to be further addressed by management



## **Risk Factor: Cyclicality**

- Smartphone trends have been uncertain and have not experienced the same rapid growth as 2009-2014

- Emerging markets may be driving significant portions of projected smartphone growth, which do not frequently utilize premium smartphones that incorporate Gorilla Glass

- Consumer sentiment sensitivity is concerning, as many products could see reduced sales in response to negative macroeconomic shifts

- Cyclicality can also work as a benefit to Corning, as inventory levels of customers has fallen since 2015 and utilization rates are high throughout panel displays and sizes

- Glass price declines over the past few quarters have stabilized
- Capital expenditures by key fiber customers could reduce if macroeconomic conditions change, causing a dent in revenue
- Uncertainty exists surrounding general macroeconomic conditions in Asia and Latin America, which accounted for 58% of Corning's 2016 revenue

## **Mitigation of Risk Factor**

- Adding additional glass to each device may help reduce the negative impacts by increasing revenue per unit

- Consumers might demand larger LCD screen size which would increase glass demand by 5-6% for every 1" in screen size

- Analyst are not projecting optimistic or excessively negative cyclicality, though changes in these dynamics could impact Corning more than the general market



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## **Global Smartphone Shipments**

## **Risk Factor: Foreign Exchange**

- Due to the location of Corning's operations, the company is exposed to exchange rate risk

- The countries that sales and operations are located in have historically experienced fluctuations; major risk is from the Japanese yen, New Taiwan dollar, South Korean won, and the Euro

- A strengthening dollar poses a risk to exchange rates to the company's investments in subsidiaries that are located overseas and assets and liabilities that result from transactions in foreign currencies

- The majority of Corning's revenue is earned in non-US currencies (55% Asia Pacific, 10% Europe, 3% Latin America & Other)

- Losses in historical years as a result of foreign currency translation adjustment are as follows:

2016: -\$0.1M

2015: -\$0.6M

2014: -\$1.1M

#### **Mitigation of Risk Factor**

- Corning protects their exposure to certain currencies by hedging to account for fluctuations

- The Japanese yen is heavily used within the Display Technologies Segment and currently fully hedges the 2017 yen-dollar at 99Y

- Projected yen exposure is also 70% hedged through 2022 at a blended yen-dollar of 106Y

- Over \$1B in contracts tied to the yen have been settled since the start of the hedging program

- Despite the current hedging program, it is difficult to assure that there will continue to be limited bottom-line impact of exchange rate changes in future years

# **V: Valuation & Recommendation**

Note: Valuation Methodologies do not take into account the dividend that would be received during the holding period of the fund

Valuation Methodology Summary for Corning	(NYSE: GLW)	DCF:	EV/EBITDA Terminal M	ultiple Method			DCF: Pe	petuity Growth Method	
DCF Perpetuity Growth Method Share Price	51.00	Terminal EV/EBITDA Multiple	8.00	10.00	12.00		Present Value of Terr	ninal FCF	37713.7
Upside (Downside) %	69.73%	Terminal EBITDA	3007.71	3007.71	3007.71		Total Present Value P	rojected Year FCF	8280.4
EV/EBITDA Multiple Method - Bear	30.05	Terminal Value	24061.65	30077.06	36092.47		Enterprise Value		45994.1
Upside (Downside) %	-6.91%	Present Value of Terminal Value	16873.28	21091.60	25309.92		Net Debt		-79.0
EV/EBITDA Multiple Method - Base	32.65	Enterprise Value	25153.68	29372.00	33590.32		Minority Interest		6
Upside (Downside) %	8.65%	Net Debt	-79.00	-79.00	-79.00		Implied Equity Value		46005.1
EV/EBITDA Multiple Method - Bull	37.33	Implied Equity Value	25232.68	29451.00	33669.32		Total Shares Outstand	ding	902.0
Upside (Downside) %	24.22%	Total Shares Outstanding	902.00	902.00	902.00		Share Price		51.0
P/FCF Multiple Method - Bear	28.85	Share Price	27.97	32.65	37.33		Current Share Price		30.0
Upside (Downside) %	-3.98%	Current Share Price	30.05	30.05	30.05		Upside (Downside)		69.73
P/FCF Multiple Method - Base	33.75	Upside (Downside)	-6.91%	8.65%	24.22%				
Upside (Downside) %	12.32%								
P/FCF Multiple Method - Bull	38.65	DC	F: EV/FCF Terminal Mul	tiple Method			Comparable Companie	s Method	
Upside (Downside) %	28.61%	Terminal P/FCF Multiple	8.00	10.00	12.00	Metric G	iLW Estimate Weighting	Valu	e from Metri
Comparable Companies Analysis	33.13	Terminal FCF	2208.41	2208.41	2208.41	EV/EBIT	31.71	0.2	6.3
Upside (Downside) %	10.26%	Terminal Value	17667.30	22084.13	26500.95	EV/Sales	26.44	0.2	5.2
Average Share Price from Valuation	25.69	Present Value of Terminal Value	17667.30	22084.13	26500.95	EV/EBITDA	41.78	0.2	8.3
Methodologies	55.00	Enterprise Value	25947.70	30364.53	34781.35	P/FCF	28.62	0.2	5.7
Current Share Price for Corping	20.05	Net Debt	-79.00	-79.00	-79.00	P/E	37.11965789	0.2	7.4
current share Price for corning	50.05	Implied Equity Value	26026.70	30443.53	34860.35	E	stimated Share Price		33.1
Unside (Deumside) %	19 729/	Total Shares Outstanding	902.00	902.00	902.00	U. U	Ipside (Downside)		10.265
opside (Downside) %	10./ 370	Share Price	28.85	33.75	38.65	80	<ul> <li>A second sec second second sec</li></ul>		
		Current Share Price	30.05	30.05	30.05				
		Upside (Downside)	-3.98%	12.32%	28.61%				



Comparable Companies Analysis for Corning (NYSE: GLW)												
Company Name	Ticker	EV/EBIT	EV/Sales	EV/EBITDA	P/FCF	P/E Gr	ross Margin	EBITDA Margin	Operating Margin	vet Debt/EBITDA	Beta	EV
TE Connectivity Ltd.	TEL	12.31	2.49	12.31	19.9	16.95	32.95	20.32	15.54	1.38	1.421	32340.7
Amphenol Corporation	APH	17.91	4.21	17.9	26.7	26.86	32.45	22.62	19.17	1.29	1.102	27411.1
EnerSys	ENS	12.87	1.29	10.5	20.5	14.6	27.49	12.24	9.96	0.37	1.795	3,081.20
II-VI Incorporated	IIVI	22.8	2.71	14.7	21.3	20.58	39.95	18.43	11.89	0.53	1.431	2634.3
Clearfield Incorporated	CLFD	22.13	2.01	18.01	25.7	42.83	43.66	16.18	14.25	-2.75	1.553	153.6
Corning	GLW	16.51	2.97	10	24.2	19	39.89	27.54	14.81	-0.54	1.191	29252.7
Mean		17.42	2.61	13.90	23.05	23.47	36.07	19.56	14.27	0.05	1.42	15812.27
GLW Estimates		31.71	26.44	41.78	28.62	37.12						



# Zero Share Price Growth

## Zero Share Price Growth Scenario

- Corning meets analyst expectations and sees a fairly stable share price over a period of approximately two years
- Fund receives dividends for the two year period before selling the shares for the purchase price
- Present value of dividends are \$0.59 for Y1 and \$0.60 for Y2, or \$1.19 total
- Fund achieves approximately 3.97% return through dividends alone

## Recommendation

Fund should allocate a small portion of AUM to Corning due to the contained downside risk and strong fundamental value within the company's R&D and patent capabilities

- Fund should have a price target of \$35.68, which is based off of the average of the valuation methodologies
- Fund should maintain coverage during ownership of the equity which enables the holding period to be flexible based on when the thesis changes
- Fund should be willing to alter allocation based on how vision on future earnings capabilities becomes increasingly clear
- Fund should have an initial estimated holding period of 12-24 months, which is when catalysts will start to make the thesis materialize

# **VI: Appendices**

Top Ten Investors						
Firm	% Ownership					
The Vanguard Group, Inc.	6.88					
State Street Global Advisors	4.53					
BlackRock Institutional Trust Compa	4.40					
Hotchkis and Wiley Capital Manage	2.35					
PRIMECAP Management Company	2.02					
State Farm Insurance Companies	2.00					
Dodge & Cox	1.79					
LSV Asset Management	1.44					
Norges Bank Investment Managem	1.21					
Lyrical Asset Management LP	1.12					
Total: Top Ten Investors	27.74					



Analyst Recommendations							
Rating	Current	Three Months Ago					
Strong Buy		3	3				
Buy		3	3				
Hold		9	11				
Underperform		2	1				
Sell		0	0				
Total		17	18				

COLUMBIA UNIVERSITY Sources: Thomson One IN THE CITY OF NEW YORK

## Patent Detail

COLUMBIA UNIVERSITY

IN THE CITY OF NEW YORK



US Patents Non-US Patents

# Debt Detail

Debt Structure								
Name	# /	Amount Issued	Amount Outstanding					
Loans	1	2,000,000,000						
Bonds	21	4,363,174,006	4,251,134,006					
Total	22	6,363,174,006						

					Corning (NY	/SE: GLW) Bor	nd Summary							
Currency	Issues					Outstanding			Issued					
U.S. Dollar							3,552,960,0			3,665,000,0	000			
Description	Maturity Date	Amount Outs	Issued Amour Cpn Class	Country	Issue Date	Debt Type	Mod Dur	OA Dur	OAS	Yield	Yid Type	Yld Event	Yld Date	Price
GLW 1 17/11/15	15-Nov-2017	250,000,000	250,000,000 Fixed Coupon	United States	31-Oct-2012	Sr Note	0.133	0.133	64.0	1.699	MAT	MAT	15-Nov-2017	100.000
GLW 2 18/05/08	08-May-2018	375,000,000	375,000,000 Fixed Coupon	United States	08-May-2015	Sr Note	0.605	0.602	54.0	1.749	MAT	MAT	08-May-2018	100.000
GLW 7 19/05/15	15-May-2019	250,000,000	250,000,000 Fixed Coupon	United States	12-May-2009	Sr Note	1.528	1.524	61.0	1.993	MAT	MAT	15-May-2019	107.000
GLW 4 20/08/15	15-Aug-2020	300,000,000	300,000,000 Fixed Coupon	United States	10-Aug-2010	Sr Note	2.707	2.711	66.0	2.209	MAT	MAT	17-Aug-2020	106.000
GLW 9 21/08/15	15-Aug-2021	61,905,000	75,000,000 Fixed Coupon	United States	15-Aug-1991	Sr Deb	3.351	3.351	114.0	2.815	MAT	MAT	16-Aug-2021	122.000
GLW 3 22/05/15 '22	15-May-2022	375,000,000	375,000,000 Fixed Coupon	United States	08-May-2015	Sr Note	4.270	4.217	82.0	2.615	MAT	MAT	16-May-2022	101.000
GLW 8 23/02/03 MTN	03-Feb-2023	5,000,000	5,000,000 Fixed Coupon	United States	03-Feb-1993	Unsecrd Nt	4.320	4.317	315.0	5.005	MAT	MAT	03-Feb-2023	114.000
GLW 8 23/02/03 MTN	03-Feb-2023	5,000,000	5,000,000 Fixed Coupon	United States	03-Feb-1993	Unsecrd Nt	4.319	4.316	315.0	5.005	MAT	MAT	03-Feb-2023	114.000
GLW 8 23/03/01 MTN	01-Mar-2023	10,000,000	10,000,000 Fixed Coupon	United States	04-Mar-1993	Unsecrd Nt	4.403	4.395	314.0	5.005	MAT	MAT	01-Mar-2023	112.000
GLW 8 23/03/01 MTN	01-Mar-2023	20,000,000	20,000,000 Fixed Coupon	United States	08-Mar-1993	Unsecrd Nt	4.403	4.395	314.0	5.005	MAT	MAT	01-Mar-2023	112.000
GLW 4 23/11/15 '23	15-Nov-2023	250,000,000	250,000,000 Fixed Coupon	United States	18-Nov-2013	Sr Note	5.407	5.292	97.0	2.955	MAT	MAT	15-Nov-2023	104.000
GLW 7 24/05/15	15-May-2024	100,000,000	100,000,000 Fixed Coupon	United States	12-May-2009	Sr Note	5.344	5.333	140.0	3.390	MAT	MAT	15-May-2024	121.000
GLW 8 24/08/01 PUT	01-Aug-2024	1,055,000	100,000,000 Fixed Coupon	United States	02-Aug-1994	Sr Deb	5.426	5.417	226.0	4.270	MAT	MAT	01-Aug-2024	120.000
GLW 7 29/03/01	01-Mar-2029	150,000,000	150,000,000 Fixed Coupon	United States	03-Mar-1999	Sr Deb	8.330	8.293	168.0	3.900	MAT	MAT	01-Mar-2029	127.000
GLW 7 36/08/15 '26	15-Aug-2036	250,000,000	250,000,000 Fixed Coupon	United States	01-Aug-2006	Sr Note	11.140	6.920	161.0	3.770	CALL	CALL	15-Aug-2026	126.000
GLW 5 37/03/15	15-Mar-2037	250,000,000	250,000,000 Fixed Coupon	United States	21-Feb-2012	Sr Note	12.911	12.789	172.0	4.177	MAT	MAT	16-Mar-2037	107.000
GLW 6 40/08/15	15-Aug-2040	400,000,000	400,000,000 Fixed Coupon	United States	10-Aug-2010	Sr Note	13.558	13.368	179.0	4.307	MAT	MAT	15-Aug-2040	121.000
GLW 5 42/03/15	15-Mar-2042	500,000,000	500,000,000 Fixed Coupon	United States	21-Feb-2012	Sr Note	14.812	14.586	161.0	4.177	MAT	MAT	17-Mar-2042	109.000
Japanese Yen				3						698,174,00	6			
Description	Maturity Date	Amount Outs	Issued Amour Cpn Class	Country	Issue Date	Debt Type	Mod Dur	OA Dur	OAS	Yield	Yid Type	Yld Event	Yid Date	Price
GLW 1 24/08/09	09-Aug-2024	187,969,925	187,969,925 Fixed Coupon	Eurobond	10-Aug-2017	Sr Note	6.687	6.687	79.0	0.717	MAT	MAT	09-Aug-2024	100.000
GLW 1 27/08/10	10-Aug-2027	420,694,594	420,694,594 Fixed Coupon	Eurobond	10-Aug-2017	Sr Note	9.369	9.367	94.0	0.969	MAT	MAT	10-Aug-2027	100.000
GLW 2 37/08/10	10-Aug-2037	89,509,488	89,509,488 Fixed Coupon	Eurobond	10-Aug-2017	Sr Note	-	-						-
Total				21		and Witness of	4,251,134,0	006		4,363,174,0	006			



							Long-Term Incen	tive					
		Short Term/Annual Incentive 2016 PIP Measures			е	2016 CPU Measures							
					(Year One of Three-Year Average Plan)								
		Core EPS Goal (Weighted 75%)		al Core Net Sales G %) (Weighted 25%		Core Net Sales Goal (Weighted 25%)		Core EPS Goal Core Net Sales Goa (Weighted 75%) (Weighted 25%)		Adjusted Operat	ing Cash (Weighted 70%)	Core Net Sal (Weighted	es Goal I 30%)
					% of				% of				
		Core EPS % c	% of 2016	Core Net	2015	Adjusted		Core Net	2015				
				Sales	Core Net	OCF less	% of 2016	Sales	Core Net				
	Achievement %	(in \$M)	Plan	(in \$M)	Sales	CapEx (in \$M)	Plan	(in \$M)	Sales				
	200%	\$1.74	112%	\$10,780	110%	and the second sec	50%						
	150%	\$1.66	107%	\$10,322	105%	\$1,912	120%	\$10,780	110%				
	125%	\$1.62	105%	\$10,094	103%	\$1,752	110%	\$10,094	103%				
TARGET	100%	\$1.55	100%	\$9,996	102%	\$1,593	100%	\$9,996	102 %				
	75%	\$1.40	90%	\$9,898	101%	\$1,354	85%	\$9,898	101%				
	50%	\$1.24	80%	\$9,800	100%	\$1,235	78%	\$9,800	100%				
	0%	\$1.16	75%	\$9,408	96%	\$1,035	65%	\$9,408	96%				

