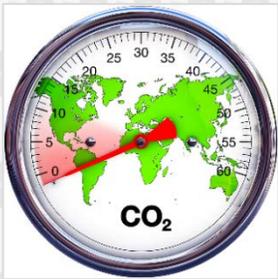


Global Market Strategy Research

The Economics of Environmental Issues in Sector Strategy

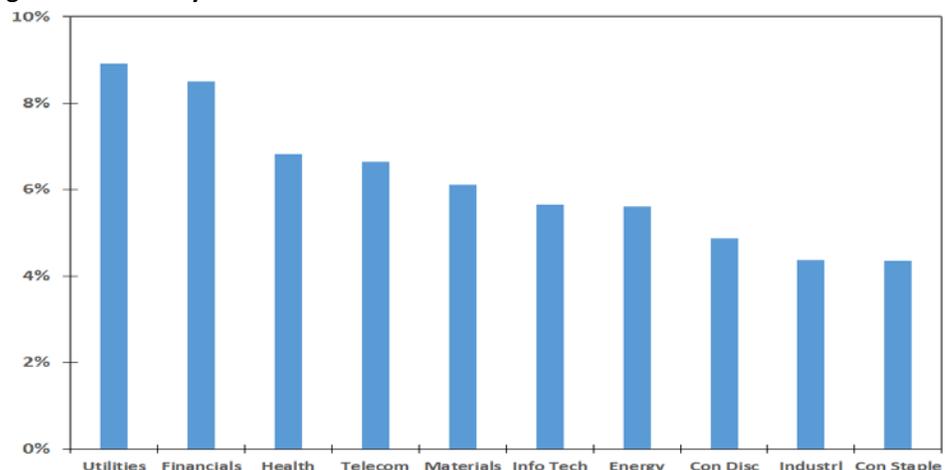


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- **Increasing environmental pressures** — Corporations globally are experiencing growing pressure about environmental issues reflecting, in large part, regulatory initiatives that could potentially increase costs. Among the factors driving the growth and stringency of environmental regulations: energy security issues, public health challenges, impact of pollution on economic growth.
- **“E” at the sector level** — We examine the implications of a potential increase in key environmental costs for ten industry sectors. Subsequent research will examine the implications — positive or negative — of social and governance factors for these sectors.
- **In our opinion, “E” costs are material** — With many externalities being priced at — or close to — zero, regulations are an effective way of imposing more realistic pricing. A sensitivity analysis that incorporates assumed prices for GHGs, water and waste suggests that a rise in *specific* “E” costs could be more material for some sectors than others. Water price: *Utilities*. Waste price: *Telecom*. CO2 price: *Industrials*.
- **Sector strategy refined** — While there is no material change in sector rankings, the new environmental metric refines our sector strategy by explicitly incorporating risks typically not captured by traditional financial analysis.

Figure 1: Sensitivity of Costs to 10% Increase in Price of Environmental Factor



Source: Cornerstone Capital Inc.

The Cornerstone Capital Sector Strategy Model

When we introduced the Cornerstone Capital Regional Strategy model in the April 2014 edition of [The Cornerstone Journal of Sustainable Finance & Banking](#) we wrote that:

- We start with the assumption that only two things ultimately determine the fair value of equities: earnings and P/E. In the short term, other factors may play a role — e.g., sentiment (“fear” or “greed”), politics (including geopolitical issues), macroeconomic variables (e.g., Central Bank tightening or easing) etc. But, in the long run, we believe it all comes down to earnings and the valuation of those earnings. A number of factors drive valuation multiples at any point in time, including perceptions of corporate governance.

In a subsequent report (“[Gauging Governance Globally: Macro and Micro Metrics](#),” September 15, 2014) our analysis reaffirmed our conviction that systematically analyzing *governance* factors gives insights into *regional* valuations. We concluded that:

- A 10% weight for a factor (i.e., national governance) generating an R-squared of 0.16 with country equity valuations seems intuitively correct.

We now turn our attention to another Environmental, Social & Governance (ESG) factor that we argue is relevant for equities — environmental costs. Our focus is the implications of a potential increase in key environmental costs for *sectors*.

We introduced our *sector* model in the May 2014 edition of [The Cornerstone Journal of Sustainable Finance & Banking](#) with our focus on the ten GICS in the MSCI All Country World Index (ACWI). This model gives a heavier weight to earnings (75%) than valuation (20%) as compared to the *regional* model, where valuation and earnings are equally weighted. The remaining 5% weight in the *sector* model is allocated to ESG factors; we have been utilizing ESG metrics calculated by MSCI in order to rank sectors by their ESG scores.

When we introduced the sector model we emphasized (as we did with the regional model) that:

- This is a dynamic model, with factors and factor weightings reviewed on a regular basis for relevance.

As we discuss in detail below, we are allocating the *full* 5% weight to environmental factors, with future research likely leading to a material increase in the ESG weight in the *sector* model in order to reflect the significance of various social and governance factors.

Global Growth in Environmental Regulations

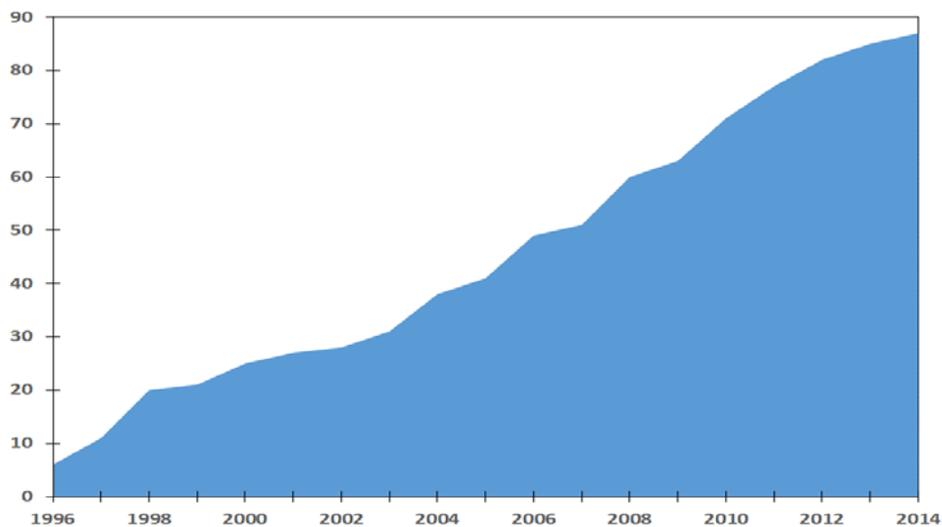
Environmental regulations are growing globally, with the majority focused on three specific issues:

- Greenhouse Gas (GHG) emissions
- Water scarcity
- Waste generation

By way of example, the U.K. “Companies Act 2006 (Strategic Report and Directors’ Report) Regulations 2013” *required* that, as of October 2013, *all* U.K. quoted companies must report on their greenhouse gas emissions as part of their annual Directors’ Report. In addition, the European Parliament adopted in April 2014 a directive on disclosure of “Non-Financial Reporting,” which will make sustainability reporting — including about environmental matters — *required* of all companies with more than 500 employees beginning 2017. It is estimated that this directive will apply to approximately 6,000 large companies across the European Union.

In the U.S., Figure 2 illustrates that the Environmental Protection Agency (EPA) has introduced 87 major new rules since 1996. Going forward, the EPA has proposed, among other things, changes to regulations that govern the treatment and discharge of power plant wastewaters; it has been estimated that such regulations could cost **American Electric Power’s** fleet of coal-fired power plants as much as \$1 billion.

Figure 2: Cumulative Number of Major New Rules Issued by U.S. EPA



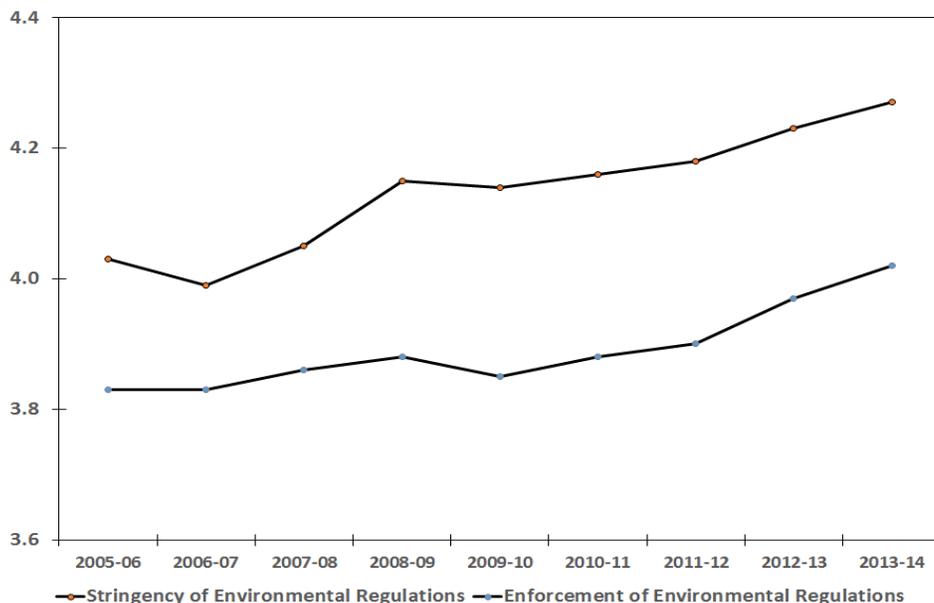
Source: U.S. Government Accountability Office and Cornerstone Capital Inc.

Various factors have been driving the growth and stringency of environmental regulations around the world:

- In Asia, stronger environmental policies are often motivated by *energy security* issues — Japan is the world’s fifth largest energy consumer, but it is a resource-poor country that imports close to all of its fossil fuel requirements.
- *Public health* challenges can play a factor — it has been estimated that poor air quality contributed to 1.2 million premature deaths in China in 2010.
- A growing realization that environmental issues could derail *economic growth* has also become an issue — the World Bank estimated the cost of pollution to China at around 9% of its gross national income.

Perhaps not surprisingly then, Figure 3 illustrates that executives globally are of the opinion that environmental regulations have become more stringent in recent years, *and* that there is greater enforcement of those regulations.

Figure 3: “How Would You Assess (i) the Stringency (ii) the Enforcement of Your Country’s Environmental Regulations?” Mean of 140 Countries where 1 = “Very Lax;” 7 = “Among the World’s Most Rigorous”



Source: World Economic Forum, Executive Opinion Survey

In response to these trends, companies in various industries have been trying to pre-empt regulation by grouping together to create voluntary standards regarding environmental and other sustainability issues. Critics argue that some of these industry-led initiatives are driven by self-interest and are nothing more than “greenwashing,” although some of the initiatives include participation by advocacy organizations. Industry groups created in recent years include:

- Banking Environment Initiative (BEI)
- Cement Sustainability Initiative (CSI)
- Consumer Goods Forum (CGF)
- Extractives Industry Transparency Initiative (EITI)
- International Council on Mining & Metals (ICMM)
- International Petroleum Industry Environmental Conservation Association (IPIECA)
- Roundtable on Sustainable Palm Oil (RSPO)
- Sustainable Agriculture Initiative (SAI)
- World Business Council for Sustainable Development (WBCSD)

The Economics of Environmental Issues in Sector Strategy

In the sections below, we discuss environmental regulations — current, planned or potential. In terms of relating these regulations to sector strategy, we examine the sensitivity of sectors’ costs to increases in the “price” of three environmental factors: GHG emissions, water usage and waste discarded.

As a first step, we calculate the significance of the three environmental factors for each sector — Figure 4.

Figure 4: Environmental Output (GHG Emissions, Waste Discarded) or Input (Water Use) Per \$ Millions of Sales

Sector	GHG (tons) / \$m Sales	Sector	Water (m3) / \$m Sales	Sector	Waste (tons) / \$m Sales
Utilities	1,558	Materials	187,022	Materials	7,573
Materials	667	Utilities	177,690	Energy	304
Energy	358	Energy	10,940	Utilities	73
Industrial	203	Financials	4,186	Industrial	59
Con Staples	63	Con Staples	1,435	Telecom	28
Info Tech	51	Health	1,244	Con Staples	28
Cons Disc	50	Industrial	1,013	Financials	12
Telecom	46	Info Tech	894	Cons Disc	9
Health	40	Cons Disc	679	Health	5
Financials	33	Telecom	145	Info Tech	3

Source: Cornerstone Capital Inc., Bloomberg, MSCI

In other words, for each \$1 million in sales the Utilities sector generates 1,558 tons of greenhouse gases, the Materials sector uses 187,022 cubic meters of water and the Energy sector produces 304 tons of waste.

Next, we assign a “price” to the three environmental factors.

- **Greenhouse gases:** The price per metric ton of Carbon Dioxide (CO₂) is currently around \$14 in the European Union Emissions Trading Scheme (EU ETS) Phase II+III EUA model price.
- **Water:** We use a price of \$1.30 per cubic meters based on a Bloomberg study of average global water prices.
- **Waste:** We use a price of \$54 to treat a metric ton of waste based on a Bloomberg analysis of average landfill prices in the U.S. and Europe.

Using these prices and the data in Figure 4 we calculate the total cost of the environmental factors by sector — Figure 5.

Figure 5: Environmental Costs Per \$ Millions of Sales

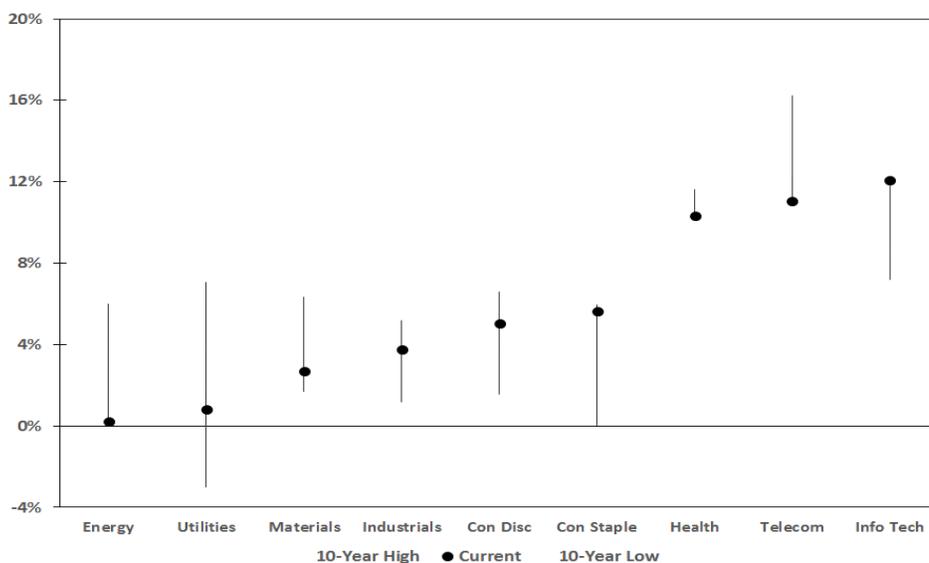
Sector	E Cost / \$m Sales	GHG Cost / \$m Sales	Water Cost / \$m Sales	Waste Cost / \$m Sales
Materials	\$661,534	\$9,485	\$243,129	\$408,919
Utilities	\$257,115	\$22,154	\$230,998	\$3,964
Energy	\$35,734	\$5,094	\$14,222	\$16,418
Industrial	\$7,371	\$2,885	\$1,317	\$3,169
Financials	\$6,558	\$469	\$5,441	\$648
Con Staples	\$4,272	\$898	\$1,865	\$1,509
Health	\$2,444	\$575	\$1,618	\$252
Telecom	\$2,358	\$653	\$188	\$1,517
Cons Disc	\$2,101	\$718	\$883	\$500
Info Tech	\$2,035	\$723	\$1,162	\$150

Source: Cornerstone Capital Inc., Bloomberg, MSCI

So, for example, the “cost” of the three environmental factors to the Materials sector is \$661,534 for each \$1 million in sales, representing the sum of GHG costs (\$9,485), water costs (\$243,129) and waste costs (\$408,919).

Not surprisingly, the rankings of the *gross* margins implied in Figure 5 roughly coincide with the rankings of the *free cash flow* margins tracked in our sector strategy model (Figure 6), with Materials, Utilities and Energy having relatively low margins, and Info Tech having relatively high margins.

Figure 6: Free Cash Flow Margins by Sector



Source: Cornerstone Capital Inc.

Figure 7 gives a breakdown of each sector's environmental cost by source: GHG emissions, water usage and waste discarded.

Figure 7: Breakdown of Environmental Costs by Sector

Sector	E Cost	GHG Cost % Total E Cost	Water Cost % Total E Cost	Waste Cost % Total E Cost
Materials	100%	1%	37%	61%
Utilities	100%	9%	89%	2%
Energy	100%	20%	24%	56%
Industrial	100%	39%	17%	44%
Financials	100%	8%	85%	7%
Con Staples	100%	26%	44%	30%
Health	100%	21%	68%	11%
Telecom	100%	25%	9%	66%
Cons Disc	100%	27%	49%	24%
Info Tech	100%	36%	57%	8%

Source: Cornerstone Capital Inc., Bloomberg, MSCI

Next, we conduct a sensitivity analysis, and examine the impact on total environmental costs resulting from a 10% increase in the price of *either* (i) GHGs, or (ii) water, or (iii) waste. Figure 8 ranks the sectors in terms of the increase in *total* environmental costs resulting from a 10% increase in *one* of the three environmental factors.

Figure 8: Sensitivity of Costs to 10% Increase in Price of Environmental Factor

Sector	Total E Cost Change: 10% GHG Price Increase	Sector	Total E Cost Change: 10% Water Price Increase	Sector	Total E Cost Change: 10% Waste Price Increase
Industrial	4%	Utilities	9%	Telecom	7%
Info Tech	4%	Financials	9%	Materials	6%
Cons Disc	3%	Health	7%	Energy	6%
Con Staples	3%	Info Tech	6%	Industrial	4%
Telecom	2%	Cons Disc	5%	Con Staples	3%
Health	2%	Con Staples	4%	Cons Disc	2%
Energy	2%	Materials	4%	Health	1%
Utilities	1%	Energy	2%	Info Tech	1%
Financials	1%	Industrial	2%	Financials	1%
Materials	0%	Telecom	1%	Utilities	0%

Source: Cornerstone Capital Inc., Bloomberg, MSCI

Note that this simple sensitivity analysis implies linearity. So, for example, a 10% increase in GHG prices results in a 4% increase in costs in the Industrial sector; a 20% increase in GHG prices (i.e., a doubling) would result in an 8% increase in environmental costs; a 30% increase in prices (i.e., a further 50% increase) would result in a 12% increase in costs.

Finally, for each sector, we identify the greatest potential increase in costs resulting from a 10% increase in *any one* of the three environmental factors — Figure 9. So, for example, a 10% increase in water prices would result in a 9% increase in costs in the Utilities sector, but only a 4% rise in costs in the Consumer Staples sector.

Figure 9: Biggest Cost Change Resulting from 10% Increase in Price of a Specific Environmental Factor

Sector	Total E Cost Change	Cause
Utilities	9%	Water 10% Increase in Price
Financials	9%	Water 10% Increase in Price
Health	7%	Water 10% Increase in Price
Telecom	7%	Waste 10% Increase in Price
Materials	6%	Waste 10% Increase in Price
Info Tech	6%	Water 10% Increase in Price
Energy	6%	Waste 10% Increase in Price
Con Disc	5%	Water 10% Increase in Price
Industrial	4%	GHG 10% Increase in Price
Con Staple	4%	Water 10% Increase in Price

Source: Cornerstone Capital Inc., Bloomberg, MSCI

It's important to bear in mind that Figure 8 and Figure 9 *reflect a sensitivity analysis*. So while a 10% increase in water prices would result in a 9% increase in environmental costs in the Financials sector, *environmental factors in aggregate are of much more significance* in the Materials (\$661,534 costs per \$1 million of sales) and Utilities (\$257,115) sectors than they are in Financials (\$6,558).

Figure 9 also illustrates that a rise in *specific* "E" costs could be more significant for some sectors than others:

- **Water prices:** A 10% increase in water prices would result in a 9% increase in costs in the *Utilities* sector.

Water usage is the total amount of water used to support a company's operational processes. (Specifically, it is the sum of all water withdraws for process water and cooling water, and all water retained by company facilities through recycling.) In the Utilities sector, electricity production is a water-intensive activity. While hydroelectric plants use water to make electricity directly, most other power production technologies — coal, natural gas, nuclear, and some types of renewable energy, e.g. biomass — use water to cool the steam that spins electricity-generating turbines. It is estimated by the U.S. Geological Survey that around 40% of all freshwater withdrawals in the U.S. are for thermoelectric power production, with the primary use being for cooling purposes.

- *Waste prices:* A 10% increase in waste prices would result in a 7% increase in costs in the *Telecom* sector.

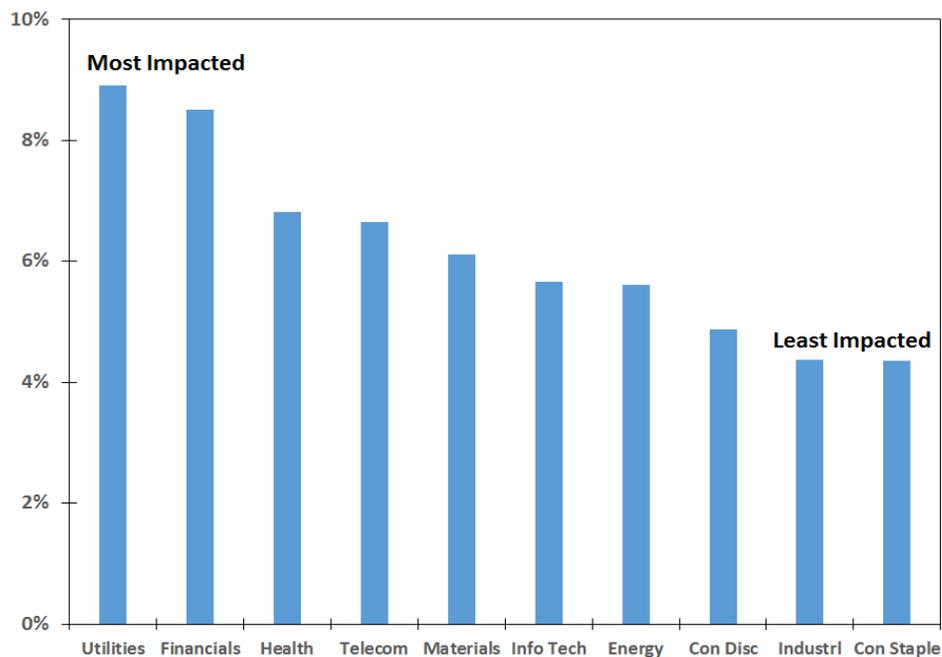
“Waste” is materials discarded by a company, both hazardous and non-hazardous. In the Telecom sector, it’s estimated that there will be 396 million unused mobile devices in the U.S. by the end of 2014, some of which could potentially end up in landfills where they might release toxins into the environment.

- *GHG prices:* A 10% increase in CO2 prices would result in a 4% increase in costs in the *Industrials* sector.

Total GHG emissions equal the total of company Scope 1 and Scope 2 emissions. Scope 1 emissions are *direct* GHG emissions from sources that are owned or operated by the company. (Sources include combustion facilities, company owned or operated transportation, and physical or chemical processes.) Scope 2 emissions are *indirect* GHG emissions that are caused by the company through the consumption of imported heat, electricity, cooling, or steam. In 2012, *direct* GHG emissions from the Industrials sector accounted for approximately 20% of total U.S. GHGs emissions, making it the third largest contributor to U.S. GHG emissions, after the Electricity and Transportation sectors. If *both direct and indirect* emissions associated with electricity use are included, the Industrials sector’s share of total U.S. GHG emissions in 2012 was 28%, making it the second largest contributor of GHG of any sector, just after transportation.

Figure 10 replicates Figure 9 in chart form, and illustrates how we rank the sectors in terms of their exposure to environmental factors.

Figure 10: Sensitivity of Costs to 10% Increase in Price of Environmental Factor
Greatest Sensitivity to Price of GHGs or Waste or Water



Source Cornerstone Capital Inc.

Our sector model assigns a 75% weight to earnings, a 20% weight to valuation and a 5% weight to ESG factors. We are allocating the *full* 5% weight to the environmental factors reflected in Figure 9 and Figure 10. By this methodology, the Utilities sector is ranked “most impacted” and Consumer Staples is ranked “least impacted,” reflecting the sensitivity of the sectors’ costs to environmental factors.

Figure 11 illustrates our sector rankings after incorporating the new environmental metric. There is no material change in the rankings — the over- and under-weights remain the same. However, we have moved the ESG column to the earnings section of the matrix in order to emphasize the potential impact that higher environmental costs could have on sectors' earnings.

Figure 11: Sector Recommendations

Sector	Recommendation	Valuation (Relative)	Earnings Momentum	Earnings Revisions	Margins (Relative)	Share Buybacks	Environmental (Relative)
Health Care	Overweight	Negative	Positive	Positive	Positive	Negative	Negative
Info Tech	Overweight	Positive	Positive	Negative	Positive	Negative	Neutral
Cons Disc	Neutral	Neutral	Positive	Negative	Neutral	Positive	Positive
Financials	Neutral	Positive	Neutral	Positive	Neutral	Negative	Negative
Industrials	Neutral	Positive	Neutral	Negative	Negative	Negative	Positive
Cons Staples	Neutral	Neutral	Neutral	Negative	Neutral	Positive	Positive
Telecom	Neutral	Neutral	Negative	Negative	Positive	Negative	Neutral
Utilities	Underweight	Negative	Neutral	Negative	Negative	Negative	Negative
Materials	Underweight	Neutral	Negative	Negative	Neutral	Negative	Neutral
Energy	Underweight	Negative	Negative	Negative	Negative	Negative	Neutral

Source: Cornerstone Capital Inc.

Finally, as noted above, while we are allocating the full 5% ESG allocation to environmental factors, future research will likely lead to a material increase in the sector model's ESG weight in order to reflect the significance of various social and governance factors.

Figure 12 lists companies mentioned in this report that seem to have exposure to some of the environmental issues that we discuss.

Figure 12: Companies Mentioned in This Report

Ticker	Name	Comment	Ticker	Name	Comment
AKZO NA	Akzo Nobel	Internal price on carbon	XOM US	Exxon Mobil Corp	Internal price on carbon
AEE US	Ameren Corp	Internal price on carbon	GOOG US	Google Inc.	Internal price on carbon
AEP US	American Electric Power	Vulnerable to water regulations	MSLH LN	Marshalls PLC	Internal price on carbon
BG/ LN	BG Group PLC	Environmental controversies	NESN VX	Nestlé SA	Environmental controversies
BP/ LN	BP PLC	Internal price on carbon	PNN LN	Pennon Group PLC	Internal price on carbon
BRFS3 BZ	BRF SA	Internal price on carbon	RDSA LN	Royal Dutch Shell PLC	Environmental controversies
BSY LN	British Sky Broadcasting	Internal price on carbon	RDSA LN	Royal Dutch Shell PLC	Internal price on carbon
CNE LN	Cairn Energy PLC	Internal price on carbon	TCK US	Teck Resources Limited	Internal price on carbon
CVE US	Cenovus Energy Inc	Internal price on carbon	TD CN	Toronto-Dominion Bank	Internal price on carbon
CVX US	Chevron	Environmental controversies	FP FP	Total SA	Environmental controversies
COP US	ConocoPhillips	Internal price on carbon	TA CN	TransAlta Corp	Internal price on carbon
DVN US	Devon Energy Corp	Internal price on carbon	DIS US	Walt Disney Co	Internal price on carbon
ECA US	Encana Corp	Internal price on carbon	WBC AU	Westpac Banking Corp	Internal price on carbon
ENI IM	Eni SpA	Environmental controversies	XEL US	Xcel Energy Inc.	Internal price on carbon

Source: Cornerstone Capital Inc.

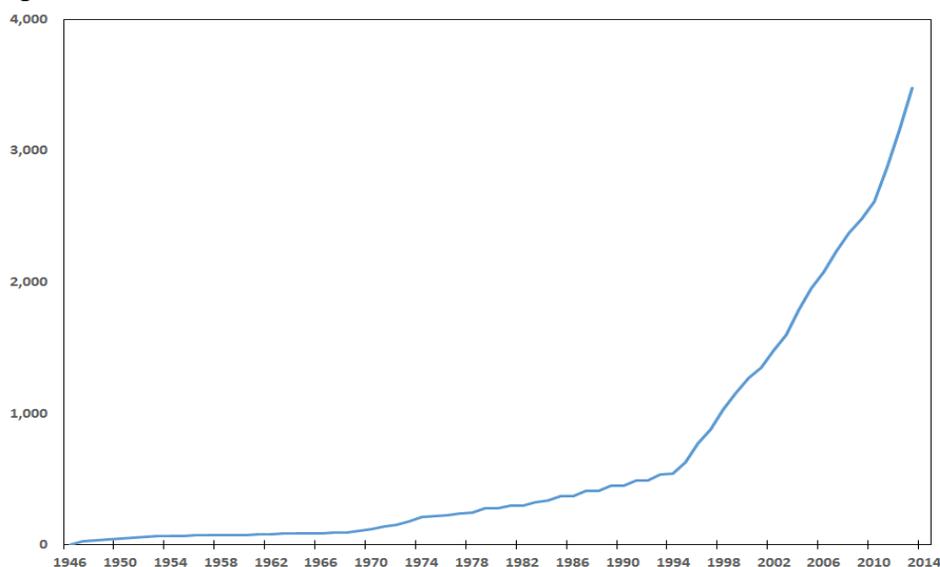
Growing Environmental Pressures

We discussed above factors that have been driving the growth and stringency of environmental regulations around the world. They include (i) energy security issues, (ii) public health challenges and (iii) the impact of environmental issues (e.g., pollution) on economic growth.

In addition to official regulations, pressure on corporations about environmental issues has been increasing for other reasons too. So, for example, the *OECD Guidelines for Multinational Enterprises* (adopted by the OECD in 1976 and last revised 2011) are a globally accepted set of recommended standards covering a number of areas, including the environment. The *OECD Guidelines* have gained significant attention in recent years, are global in scope, command official state level cooperation and have grievance systems.

Since 2001, over 175 complaints have been filed via the OECD complaint mechanism against multinationals, including allegations of environmental harm. So, for example, in 2013 **British Gas**, **Chevron** and **ENI** were the subject of complaints pertaining to environmental issues. Over 200 non-governmental organizations (NGOs) — including Friends of the Earth and World Wildlife Fund — have used the OECD complaint mechanism. The number of NGOs has increased markedly in recent years — Figure 13 illustrates that almost 4,000 NGOs currently have consultative status with the United Nations.

Figure 13: Number of NGOs in Consultative Status with the UN Economic and Social Council



Source: UN Economic and Social Council

In addition to complaints to the OECD, NGOs have also employed other tactics. So, for example, reflecting activism by the WWF and other environmental NGOs, oil companies **ENI** and **Total** dropped plans to drill in Africa's Virunga National Park, which has UNESCO World Heritage status. Similarly, following intense environmental NGO campaigning, **Royal Dutch Shell** agreed not to explore within any natural World Heritage sites.

It's also noteworthy that **Nestlé** suspended sourcing palm oil from an Indonesian supplier that was accused by Greenpeace in a social media campaign of unsustainable forest clearing. The rise of social media (Facebook, Twitter, etc.) means that anyone with an agenda (environmental or otherwise) can use social mobilizations to exert pressure on corporations and regulators.

The Regulation of GHG Emissions

A recent report¹ observed that:

- 2013 was a period of transition in global climate diplomacy. The international negotiations are slowly gearing up towards the crucial 2015 Conference of the Parties/Meeting of the Parties in Paris. Among developed countries, U.S. President Barack Obama raised the bar when he promised to “respond to the threat of climate change” in his inaugural State of the Union address after his reelection, and subsequently published a Climate Action Plan. With the worst of the economic crisis over, the European Union began to focus again on climate policy and its climate objectives beyond 2020.

To be sure, *national* achievements are often also supported and, in some cases, surpassed by the legislation produced by *states* and *provinces* — the U.S. and Canada are cases in point. Similarly, *within* the European Union, some countries have been much more aggressive than others in trying to reduce GHG emissions. So, for example, Germany’s *Energiewende* (energy revolution) is a trillion-euro plan to wean the country off nuclear and fossil fuels by midcentury, and is a top domestic priority of Chancellor Angela Merkel.

It was estimated in the aforementioned report that nearly 88 percent of current GHG emissions are covered by climate legislation in 66 countries. In recent years, emerging economies have passed climate change laws and regulations at a faster pace than developed countries. That said, a key point is:

- *The number of climate laws and policies is not a perfect indicator of a country’s commitment to climate action and is only loosely correlated with climate change ambition...In addition, there are issues of context and comparability: a given law or policy in one country does not necessarily have the same impact as it would in another [italics added].*

So, for example, the U.S. Clean Air Act is *included* in the climate change legislation list of 66 countries because “following the ‘endangerment finding,’ the EPA is now required to regulate gases for their GHG potential under the Clean Air Act.” However, in the scheme of things, the fact that the U.S., a relatively large GHG emitter, does *not* actually have a comprehensive *national* GHG policy is of more significance than South Africa’s ambitious national schemes, given that South Africa accounts for only about 1% of global GHG emissions — Figure 14.

Figure 14: GHG Actions in Major Emitting Economies

Country	Carbon Pricing	Clean Energy	Energy Efficiency		Transport	Percent of Global Emissions
		Renewables Target	Appliance and Building Standards	Energy Efficiency Obligation	Vehicle Performance Standards	
Brazil	Committed/Under Consideration	National Action In Place	National Action In Place	National Action In Place		2.7%
Canada	Sub-National Action In Place	National Action In Place	National Action In Place		National Action In Place	2.0%
China	Sub-National Action In Place	National Action In Place	National Action In Place		National Action In Place	19.1%
European Union	National Action In Place	National Action In Place	National Action In Place	Sub-National Action In Place	National Action In Place	13.4%
India	National Action In Place	National Action In Place	National Action In Place	National Action In Place	Committed/Under Consideration	4.9%
Indonesia		National Action In Place	National Action In Place			1.5%
Japan	National Action In Place	National Action In Place	National Action In Place		National Action In Place	3.6%
Mexico	Committed/Under Consideration	National Action In Place	National Action In Place		Committed/Under Consideration	1.7%
Republic of Korea	Committed/Under Consideration	National Action In Place	National Action In Place		National Action In Place	1.5%
Russian Federation		National Action In Place	National Action In Place			5.2%
South Africa	Committed/Under Consideration	National Action In Place	National Action In Place	National Action In Place		1.1%
United States	Sub-National Action In Place	Sub-National Action In Place	Sub-National Action In Place	Sub-National Action In Place	National Action In Place	18.3%

Source: Government of Australia Department of the Environment, Cornerstone Capital Inc.

¹ *GLOBE Climate Legislation Study, 2014*

Even still, major companies worldwide are either already experiencing higher costs associated with environmental regulations, or are making plans that assume higher costs:

- Because of Germany's *Energiewende*, average electricity prices for companies have jumped 60% over the past five years reflecting costs passed along as part of government subsidies of renewable energy producers. Electricity prices are now more than double those in the U.S.
- A recent report² from the CDP highlighted that 150 major corporations around the world are using an internal price on carbon in anticipation of being taxed on their carbon emissions. Figure 15 lists the internal carbon price of some of those companies.

Figure 15: Internal Price of Carbon Assumption

Ranked by Price Assumption from Highest-to-Lowest

Company	Country	Price (US\$)
Pennon Group	United Kingdom	\$84-\$324
Exxon Mobil Corporation	U.S.	\$60-\$80
AkzoNobel	Netherlands	\$65
Teck Resources Limited	Canada	\$30-\$60
Encana Corporation	U.S.	\$10-\$80
Cenovus Energy Inc	Canada	\$15-\$65
BP	United Kingdom	\$40
Royal Dutch Shell	Netherlands	\$40
Ameren Corporation	U.S.	\$30
Cairn Energy	United Kingdom	\$30
ConocoPhillips	U.S.	\$8-\$46
Mars	U.S.	\$20-30
Xcel Energy Inc.	U.S.	\$20
British Sky Broadcasting	United Kingdom	\$19
Marshalls	United Kingdom	\$19
TransAlta Corporation	Canada	\$15-\$23
Walt Disney Company	U.S.	\$10-\$20
Devon Energy Corporation	U.S.	\$15
Google Inc.	U.S.	\$14
TD Bank Group	Canada	\$10
Westpac Banking Corporation	Australia	\$10
BRF S.A.	Brazil	\$7

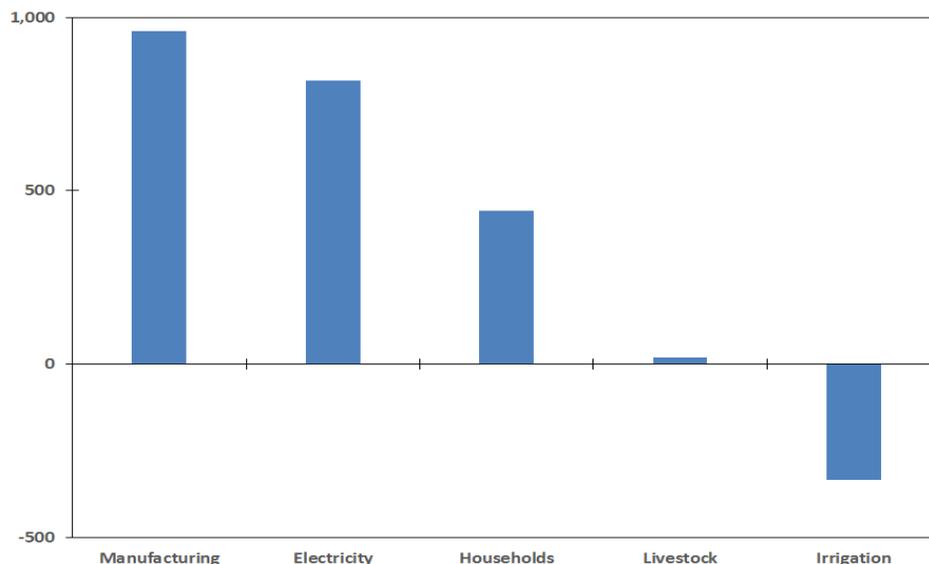
Source: CDP

² "Global Corporate Use of Carbon Pricing — Disclosures to Investors," September 2014

Upward Pressure on Water Prices

Turning from outputs (i.e., emissions) to environmental inputs, water is a natural resource without substitute. Demand for the precious resource continues to rise globally driven by population growth, industrial expansion and urbanization. Figure 16 illustrates that the OECD forecasts that, over the next few decades, the greatest increase in demand for water will come from the manufacturing sector.

Figure 16: Change in Global Water Demand 2000 – 2050 by Sector (Cubic Kilometers)



Source: OECD

At the same time, the world's fresh water supply is shrinking. As the *World Bank* points out:³

- The world is facing increased water stress, driven by population and economic growth, land use changes, increased climate variability and change, and declining groundwater supplies and water quality.

However, there is often little incentive for efficient usage as water has no price, or is priced too low to act as an incentive for efficient resource allocation. Commenting about the ongoing drought in California, *The New York Times* recently pointed out⁴ that:

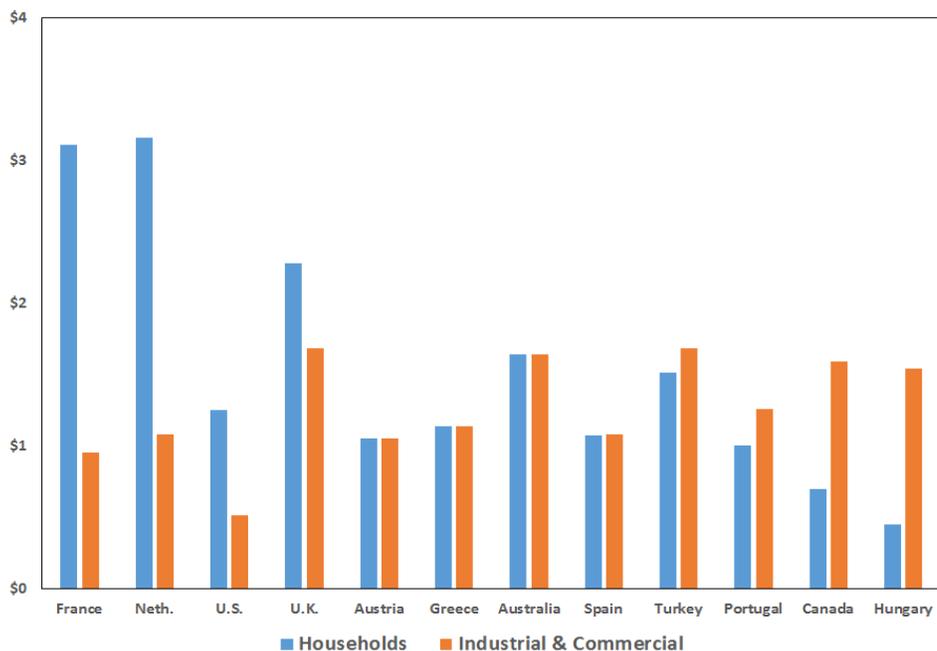
- The proliferation of limits on water use will not solve the problem because regulations do nothing to address the main driver of the nation's wanton consumption of water: its price.

Moreover, in many countries, the price for domestic and household water is *higher* than the price for the industrial and commercial sector (Figure 17). The differences can be very large — in France, households are charged, on average, \$3.11 for each cubic meter of water used while the commercial and industrial sector is charged just \$0.95.

³ <http://www.worldbank.org/en/topic/water/overview>

⁴ "The Risks of Cheap Water," October 14, 2014

Figure 17: Prices for Water by Broad Sector Usage (\$ per Cubic Meters)



Source: OECD

In terms of costs, the provision of clean water is very expensive encompassing, among other things, water treatment as well as transport from the source to the user. (Water is heavier than oil; a system to move it long distances — especially if it involves tunneling — can cost billions.) Yet, on average worldwide, municipal suppliers do not charge enough for water to meet even their basic operational and maintenance costs.

For a variety of reasons, therefore, it seems that the trend in global water prices in the industrial and commercial sectors will be upward. Price hikes will be necessary in order to:

- Cover the cost of delivering water, as well as the depreciation of utilities' infrastructure and their R&D.
- Fix pipeline leakage in developed countries (where, in many instances, pipelines were laid over one hundred years ago) and expand network infrastructure in emerging economies.
- Cover higher costs for more expensive water supplies such as recycled and desalination water.

Increasing Regulation of Waste

Governments worldwide have been implementing more stringent and taxing waste management regulations. To be sure, the degree of regulation of waste is regional, with developed economies, in general, being more focused on the issue than most emerging economies — Figure 18.

Figure 18: Government Policies on Waste Management

Region	Government Policy Support	Comment
Africa	No Priority	
Asia	Medium Priority	The high-income Asian countries have strong government policy support on reducing and managing the amount of waste generated; government support is lacking in the low-income countries
Australia	No Priority	
Europe	High Priority	EU has a strong focus on managing solid waste and environment under the EU directive to regulate the sector
North America	Medium Priority	U.S. policy for waste management is primarily driven by the states
South America	Low Priority	Majority of South American countries do not have a policy focus on the management of solid waste

Source: THE GLOBAL CLEANTECH REPORT 2012

As Figure 18 illustrates, the European Union is at the forefront of waste management policies. The *EU Waste Framework Directive* provides guiding principles outlining the rules and requirements to be fulfilled by member countries in the area of solid waste management. Additional directives include the *Waste Electrical and Electronic Equipment Directive* and the *Packaging and Packaging Waste Directive*.

In the U.S., the federal government's *Resource Conservation and Recovery Act* required the Environment Protection Agency (EPA) to specify policies for regulation of hazardous waste. However, the bulk of the legislation in the U.S. for the disposal of solid waste and the promotion of recycling has come from state legislations.

Globally, two types of waste are increasingly being targeted:

- Landfill waste (about 70% of global waste ends up in a landfill).
- Electrical and electronic waste aka “e-waste” (one of the fastest-growing waste segments).

Landfill Waste

Landfill sites are for the disposal of waste by burial and are the most common method of organized waste treatment globally. They account for upwards of 50% of waste disposal in the U.S. and the U.K., one-third in the EU and close to 100% in a number of emerging economies. In both Europe and the U.S. landfills have been facing challenges because:

- The availability of space for landfill has been on the decline, so that landfills are being located farther away from cities, thereby increasing costs associated with the transport of waste to landfills.
- There is growing awareness about the pollution caused by landfills.

In Europe, landfill taxes have been introduced in recent years and have had a significant impact on landfill treatment's share of total waste treatment (although, as noted, landfill sites still account for one-third of waste disposal in the EU). While the U.S. has no national landfill tax, many state and local governments collect "tipping" fees on the disposal of waste.

With regard to environmental issues, landfill methane is *a significant source of GHG emissions* (landfill gas is 50-60% methane). Methane is caused by the anaerobic degradation of organic material in landfills and dumps and is 20x more potent than CO₂ in terms of its climate change impact.

E-Waste

E-waste — discarded electrical or electronic devices — is one of the fastest-growing waste segments globally. This segment typically covers discarded PCs, office electronic equipment, entertainment device electronics, mobile phones, television sets and refrigerators.

The EU's *Waste Electrical and Electronic Equipment Directive* (WEEE) set collection, recycling and recovery targets for all types of electrical goods. The overall aim is for the EU to recycle at least 85% of electrical and electronics waste equipment by 2016. The directive imposes the responsibility for the disposal of WEEE on the manufacturers or distributors of such equipment. It requires that these companies establish an infrastructure for collecting WEEE, in such a way that "users of electrical and electronic equipment from private households should have the possibility of returning WEEE at least free of charge". Similarly, in the U.S. the proposed *Responsible Electronics Recycling Act* (RERA) would increase EPA oversight of electronic waste handling and disposal, among other things.

A number of companies are already acting before waste legislation is introduced. Some of them are motivated, in part, by the fact that certain waste contains materials that if extracted and recycled can be reused, generating significant life-cycle cost savings. So, for example, recycling one million cell phones can recover about 50 pounds of gold, 550 pounds of silver, 20 pounds of palladium, and more than 20,000 pounds of copper.

It's estimated that there will be 396 million unused mobile devices in the U.S. by the end of 2014, some of which could potentially end up in landfills where they might release toxins into the environment. Sprint has a goal of collecting nine phones for reuse or recycling for every 10 it sells annually by 2017, or a 90% collection rate; in 2013 Sprint's collection rate was 47%.

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