A large wind turbine stands in a green field, with a small white building at its base. In the background, there are rolling green hills, a line of trees, and snow-capped mountains under a soft, hazy sky. The overall scene is peaceful and scenic, emphasizing renewable energy in a natural setting.

September 2017

Environmental Productivity

Enhancing Business & Investor
Decision-Making



TERRA ALPHA
INVESTMENTS

Terra Alpha Investments, LLC is an advocacy investment firm established in 2014.

Our vision is to drive systemic change in the economy, so that it is more aligned with our natural systems.

Our firm's mission is to demonstrate that Environmental Productivity enhances long-term returns as expressed in real investment results and to advocate for the widespread adoption of Environmental Productivity across the global economic system.

At Terra Alpha, we believe that a portfolio of the world's most fundamentally strong, attractively valued, and environmentally productive companies will provide our investors with better long-term risk-adjusted returns. We believe that asset owners also want their investments to reflect their shared interest in a better environment for all. We believe that our investment process and our advocacy work will drive the global economy to be more aligned with the world's finite natural systems to help create a better world.

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Environmental Productivity: Enhancing Business and Investor Decision-Making

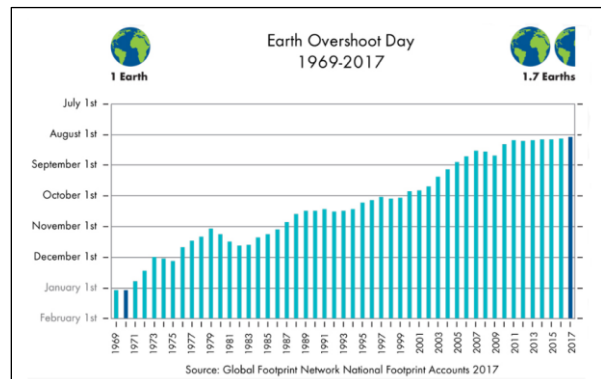
Successful companies maximize operational efficiency and shareholder returns. Investment professionals seek incremental informational advantages in their quest to generate superior returns for their clients. In a resource-constrained world, **Environmental Productivity (EP) analysis** is an essential tool all business leaders and investors should include in their decision-making tool box to enhance returns.

Environmental Productivity analysis is a measure of operational efficiency. Just as labor productivity measures a company's efficiency in its use of labor, environmental productivity analyzes a company's current and planned efficiency in its use of and impact on natural resources (e.g., greenhouse gas emissions, water use, as well as the use of raw materials, forests, and arable land). Using environmental data as part of the analysis for any decision-making can reduce risks and identify opportunities.

Our World's Finite Natural Resources - A Limiting Factor to Long-Term Economic Prosperity

One of today's most pressing challenges is the demand the earth's population of 7.4 billion people is putting on its natural systems and their finite amount of natural resources. These resources include clean water and clean air necessary for human health and business operations, topsoil that is essential for agriculture, and raw materials (e.g., minerals and forest products) that are used in manufacturing. Already these stocks are under pressure and inaccessible to millions of people.

Global Footprint Network estimated that in 2017, humans consumed all of the resources the planet can regenerate over the course of an entire year by August 2nd.¹ Beyond that day, global economic demands are effectively borrowing resources from future generations, creating a "natural resource debt" with no means to repay it. Recent trends show that demands for and negative impacts on these resources are only growing.



Demographic projections indicate that there will be almost 10 billion people on the planet within the next 30 years.² Absent any improvement in how efficiently humanity consumes natural resources, the growing population, coupled with an increasing portion of people in the global "middle class," has the potential to triple the demand for natural resources by 2050.³ Simple supply/demand models would therefore suggest that this will lead to higher and more volatile pricing for the use of and impacts on the planet's natural systems. Additionally, these costs - which have historically been viewed as "externalities" for companies - are increasingly being pushed onto companies' income statements and balance sheets by regulatory and investor pressures. Hence, companies need to evolve their operations to assure success in this world of increasing constraints on natural resources. **Those companies that are adopting more natural-resource efficient business models will be better prepared to withstand the risks and take advantage of the opportunities of the future.**

It must also be noted that while some sectors of the economy have higher levels of natural resource intensity than others (e.g., the food industry with water and soil, electricity with air and water, manufacturing with raw materials), all sectors are impacted by resource challenges. For example, banks

are exposed to risk as they provide capital to high natural-resource intensive and/or highly capital-intensive companies, insurers are directly impacted by changing weather patterns, and data center providers and cloud computing companies are very sensitive to the cost of electricity and water availability for cooling. Hence, EP analysis is important across all sectors of the global economy though the specific research varies by sector.

Investors - Competitive Returns and Global Impact

Evaluating investments using Environmental Productivity as a key consideration, along with other analysis such as financial, strategic, managerial, competitive, and valuation considerations, can give investors a more detailed assessment of a potential investment. Environmental data analysis gives valuable insight into how a company is currently utilizing natural resources. Further research into a company's plans and targets for improving its Environmental Productivity will provide useful information for forecasting future earnings and returns.

Does this approach - using the "Environmental" factor of Environmental, Social, and Governance (ESG) data as a key evaluative criterion - make the resulting investment "only" an "impact investment"? On the contrary, the use of Environmental Productivity is primarily focused on providing better risk-adjusted returns for investors. The subsequent reduction in negative impacts on natural capital resources is a secondary benefit. Corroborating this approach is a growing body of research demonstrating that companies with higher environmental awareness provide higher returns for their shareholders.

- An S&P Dow Jones Indices study determined that "despite limited data history, preliminary findings show that more carbon- and resource-efficient companies may outperform the less-efficient ones. Focusing on efficiency could help businesses mitigate risks such as regulation, resource depletion, and reputational risks."
- Research on sustainability as a driver of financial outperformance used 200 sources of research on ESG and found 80% of the studies showed a positive investment return from companies with diligent sustainability practices.⁴
- A Harvard Business School study showed that where companies invested in "material" sustainability projects - identified via industry-specific classifications of material sustainability areas - those firms with "good" ratings on material sustainability issues outperformed.⁵

Importantly, the broader the adoption of using this data and Environmental Productivity analysis, the greater the pressure on the economic system to be more environmentally prudent and conscious of natural resource need and use. **Wide-scale adoption of Environmental Productivity in business and investing will cause change to the economic system and its use of natural resources. In this way, investing with EP is an "impact investment" approach, but at its core, it is simply a better way to evaluate investment opportunities.**

For active investors, finding informational advantages that generate improved returns is a constant endeavor. With the growth of passive investment products (e.g., index funds and ETFs), it has never been more important. For fiduciaries, being able to better assess their investment managers' and funds' (active or passive) abilities to find opportunities and manage risks is an ongoing challenge. The tracking

of environmental data (along with other ESG factors) can provide a more detailed picture of companies and assets not yet found in mainstream reporting nor in brokerage house research.

Environmental Productivity - Defined

Terra Alpha Investments, LLC developed an Environmental Productivity evaluation metric based on decades of investment experience and extensive understanding of both environmental systems and the growing availability of environmental data. This research began to illuminate that many leading companies had begun to work hard to shift their operations to be more aligned with the realities of natural systems. These companies recognized that their own operations and their supply chains were facing resource challenges, and that their employees and their customers were increasingly mindful of the impacts the company was having on natural resources. Concordantly, it is becoming evident that companies that are prepared for a resource-constrained future - amongst other factors - will be better long-term investments. Environmental Productivity is really a necessary and natural addition to an investor's toolkit for evaluating companies today and in the future. It is a way to gauge how effectively companies will be able to navigate future shifts in resource quality and availability.

Environmental Productivity is Today Mostly a Data-Driven Analysis

Environmental Productivity analysis is a data-focused methodology for companies and investors. It accounts for and is defined as: the efficiency with which companies use and impact natural resources. A company tracks, records, and then reports on energy use, carbon emissions, water use and impact, and material usage and waste. Measuring the data typically leads to managing resource use more efficiently, resulting in lower costs and added value.

The environmental data reporting process is relatively new. The first such reporting was in the early 2000s. It has been led by several key organizations including: CDP (formerly the Carbon Disclosure Project), Global Reporting Initiative, CERES, and others. These early proponents of greater environmental disclosure were supported by many large global banks and investment organizations who lent their names to the work. More recently, organizations like the Sustainability Accounting Standards Board (SASB) and the Task Force for Climate-related Financial Disclosures (TCFD) have been created to add weight to the effort and find ways to standardize and improve the information flow. Combined, these efforts are moving environmental data disclosure toward the mainstream. Over 2,000 publicly-traded companies globally disclosed their environmental data in 2016. This includes well over 70% of the market capitalization of the S&P 500 Index. It is reasonable to expect that the vast majority of mid-cap and large-capitalization companies will be reporting their primary environmental data within the next five years.

Integration Into Policy

Recognition of the usefulness and importance of environmental factors is also reflected in the growing number of regulatory and market changes. A number of stock exchanges globally have begun requiring disclosure of varying amounts of ESG data (information regarding a company's environmental, social, and governance performance) as a listing rule. Brazil (BM&FBOVESPA), Canada (Toronto Stock Exchange), Hong Kong (Hong Kong Exchanges), India (NSEI & BSE India), South Africa (Johannesburg Stock Exchange), Singapore (Singapore Exchange), Thailand (Stock Exchange of Thailand) and Malaysia (Bursa Malaysia) are several that have set such requirements.⁶ The New York

Stock Exchange and NASDAQ have given guidance that companies should disclose ESG factors when they consider the factors to be material data.

There is an increasing amount of regulation around environmental and sustainability reporting from national governments, as well. As of 2015, there were 180 laws and regulatory standards in 45 countries calling for some aspect of corporate sustainability reporting.⁷ In 2013, amendments to the UK Companies Act required UK quoted companies to report their greenhouse gas emissions, as well as climate change risks faced by their business and strategies for mitigation ([The Companies Act](#)). The French government currently requires listed companies - as well as investors, banks, credit providers, and insurance companies - to disclose the risks they face from climate change and how they are managing them ([French Energy Transition Law, Article 48](#)).

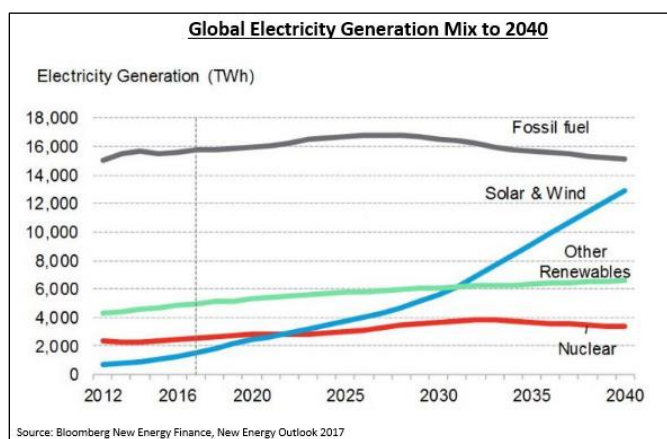
The U.S. Department of Labor, in a recent update to its ERISA guidance ([Interpretive Bulletin 2015-01](#)), acknowledged a material relationship between the economic and financial value of an investment and environmental, social, and governance factors, and it encourages inclusion of environmental factors in investment considerations for fiduciaries.

Currently, the most available environmental metrics relate to energy, water, waste, and forests. Terra Alpha Investments has written extensive reports on the first three areas. Brief summaries of each are provided below.

Emitting Money

Assessing energy efficiency and reducing greenhouse gas emissions is often a money-making proposition for companies.

It starts with using the company's disclosed data on greenhouse gas emissions – Scope 1 and 2 (and Scope 3, when possible)⁸. In addition to their contribution to a warming and increasingly unstable planetary climate, greenhouse gas emissions can relay information about a company's energy use and point to risks or opportunities as regulations and markets increasingly move toward global efforts to combat the negative impacts of climate change.



Companies that employ renewable energy sources, improve energy efficiency, and reduce emissions will be better positioned to provide long-term investment returns in a future replete with fluctuating commodity prices, an increasingly strict regulatory environment, and political and economic instability. These changes are already beginning to materialize and will only accelerate. For example, it is estimated that nearly 70% of all new electric capacity added in the next 25 years will be from renewables.⁹

- New York-based utility Con Edison estimates it will save roughly \$1 billion by deploying a mix of renewables (e.g., solar and fuel cells) and demand side management efforts instead of building out conventional energy infrastructure to accommodate growing demand in New York City.¹⁰

- Hilton Worldwide's environmental management efforts have reduced energy use by 14.5% and carbon output by 20.9%, compared to 2009 levels, and resulted in savings of \$550 million since 2009.¹¹
- UPS's On-Road Integrated Optimization and Navigation (ORION) algorithmic program helps drivers optimize routes with regard to fuel, distance, and time. First rolled out to 10,000 routes in 2013, UPS saved more than 1.5 million gallons of fuel, 14,000 tonnes of GHG emissions, and roughly \$50 million a year. Orion is expected to be fully deployed to nearly all 55,000 routes in North America by 2017, at which point, it is expected to generate savings of \$300-\$400 million per year.¹²
- In 2014, General Motors generated nearly \$1 billion in annual revenue through reuse and recycling of its by-products, which also avoided releasing over 10 million tons of CO2-equivalent emissions into the atmosphere.¹³ Some projects that create greater efficiency are basic and uncomplicated but at scale are impactful: simple efforts like replacing light fixtures and bulbs and installing motion sensors on lights throughout buildings can have a noticeable financial impact, particularly across multiple facilities. Checking air handlers for leaks and using high R-factor insulation can decrease energy intensity. Installing renewable energy sources may require an upfront cost but pay long-term profit benefits into perpetuity.

Navigating Rough Waters

Fresh water is only 2.5% of the earth's supply, 70% of which is inaccessible.¹⁴ Limited or no access to water - what was once a distant concept to businesses - has now become reality for many, and a near-term challenge globally. Global water resources are increasingly stressed, and the impacts reach across all sectors. California's 2007-16 drought illustrated this clearly.

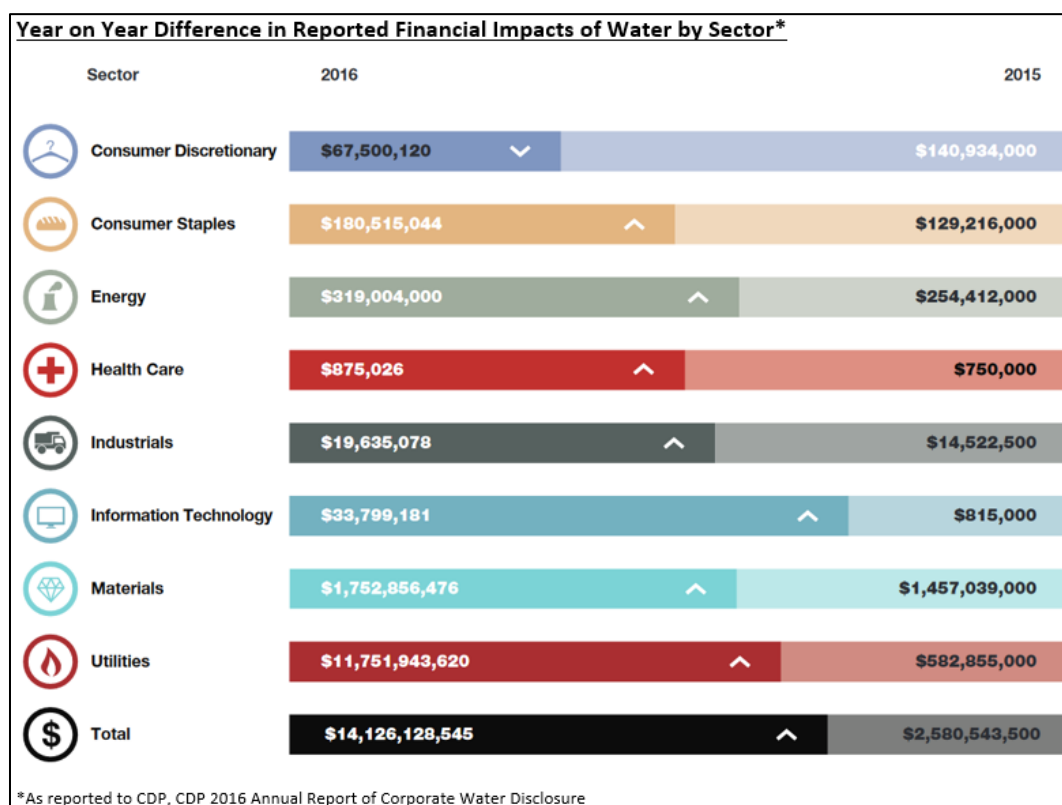
Competition for water can disrupt operations, damage reputations, and constrain growth. As part of its 2015 Global Water Report, CDP surveyed roughly 1,000 public companies, 405 of which reported detrimental water challenges that totaled more than \$2.5 billion. Droughts in the U.S. in 2011 halved the production of cotton, causing cotton prices to spike. Gap Inc.'s share price fell 17% after cutting its full-year profit forecast by 22% due to the scarcity of cotton.¹⁵

Also in 2011, higher than average rainfall aligned with other factors to cause Thailand's worst floods in 50 years. Almost 40% of the world's hard disk drive (HDD) production and manufacturing facilities were located in Thailand's Chao Phraya River valley, a known floodplain. The severe floods caused massive evacuations, factory shutdowns, and supply chain disruptions for all industrial processes located in the valley.¹⁶ Hard drive shipments fell 30% below demand orders.¹⁷

- Emerson Electric saw net income fall 23% after costs rose and sales decreased due to supply chain disruptions from these Thai floods. The negative impact also affected the stock price: Emerson shares were down close to 3% relative to the S&P 500 Index on the report date.¹⁸
- The world's biggest hard drive maker, Western Digital Corp., was forced to close its Thai factories, where it made 60% of its hard disk drives. Its operations and ability to meet customer demand were seriously impacted. Shares dropped 7% in one day.¹⁹
- The global shortage of HDDs added \$5 to \$10 to the cost of each hard drive, as reported by Lenovo Group Ltd., the world's second-biggest maker of PCs. Other industries were also affected.²⁰

- Toyota, Honda, Nissan, and Ford all felt the effects of the Thai floods on their earnings; the floods caused these companies to close their Thai plants, and the shortages of parts slowed manufacturing around the world. Honda faced costly repairs to its flood-damaged factory; it was forced to delay model releases, and it reported negative earnings that quarter. In 2011, Honda's stock was down 28%. Toyota reported an 18.5% net income drop, a 4.8% decline in revenue, and a 32.4% fall of operating profit. Toyota's stock was down 22% following the negative earnings report.²¹

These floods were not hydrologically unprecedented; companies should have been prepared for flood risk losses from operational and supply chain disruption.²²

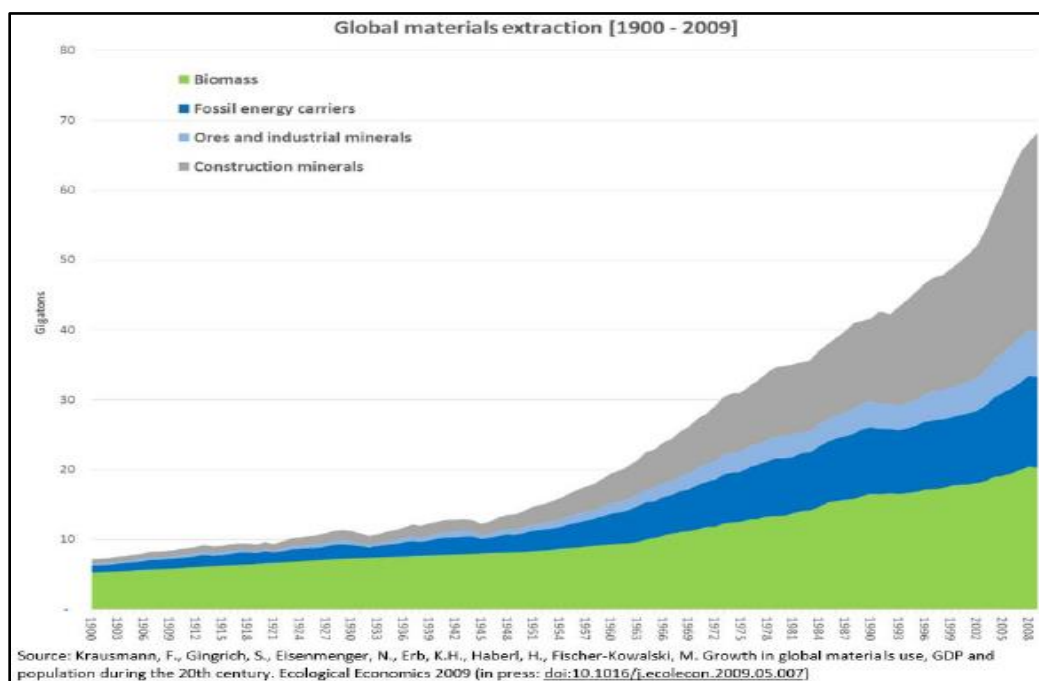


Conversely, the information technology company Cognizant was prepared and able to implement continuity plans by shifting operations to another location when floods closed all 11 offices in the city of Chennai in December 2015. There was no impact on its operations as a result, nor on its stock price. For investors, this means that information about a company's water vulnerabilities and opportunities, and the strategy for addressing them, is a material investment consideration.

Investing in a Resource-Constrained World

Collecting data on material use and waste production is a fairly simple means to assess the financial advantages of a company's material-use efficiency. Material extraction and waste generation have historically undergirded global economic growth and are both increasing as global consumption continues to grow. Non-renewable materials account for 70% (and rising) of global material extraction,

and an estimated 20% of material extraction becomes waste.²³ A UNEP report warned that current development trends “probably exceed all possible measures of available resources.”²⁴



Risks and opportunities manifest in operational, reputational, regulatory, and strategic realms for companies regarding material use and waste production. The collection of a company’s physical waste is typically an obvious and quantifiable company expense; hauling away less waste makes an immediate reduction on company cost. Content used can make a material difference too.

- In 2013, only 7.2% of Pepsico’s waste was sent to a landfill, allowing the company to avoid \$3 million in landfill disposal costs.
- Walmart reduced the number of corrugated cardboard boxes used for apparel in FY2016 by 8.1 million over FY2015, equaling 6.3 million pounds of cardboard, saving \$15.3 million in operational costs (and 7,800MT of greenhouse gases).
- In March 2015, a “60 Minutes” report exposed unlawfully high levels of formaldehyde in laminate flooring from Lumber Liquidators. The company was subject to investigations and fines, and its stock fell over 80% from its 2015 peak.²⁵ Had the company properly assessed the intensity and content of its material inputs, perhaps the damage could have been avoided.

Those companies that reduce material extraction, achieve little to no waste during processing, and recycle, reuse, or resell what is leftover, will realize considerable positive returns and limit their exposure to resource scarcity in the future. Companies that assess their material efficiency can avoid regulatory and reputational damage.

The Value of Healthy Soil and Forests

Topsoil and forests are both critical and complex natural resources/sub-systems that provide an array of societal, environmental, and economic benefits. The immense global loss of forests and degradation of soil health have contributed to rising GHG concentrations in the atmosphere while creating a myriad of other societal, environmental, and economic challenges. The current state of understanding, measuring, and reporting of these impacts is still in its nascence. Regardless, Terra Alpha continues to research the best means for incorporating forest and soil health information and data into investment decision-making in a rigorous way.

Inclusion of Environmental Productivity Measures - A Better Way to Operate and Invest

Reducing the intensity of natural resource usage and increasing environmentally productive business practices enhance the prospects for better long-term returns for corporations and patient capital investors. Further, companies that fail to develop environmentally productive methodologies for managing their use and impact on carbon, water, and materials are at greater risk; those that recognize challenges can find opportunities for growth. Many of the world's best companies already measure, manage, and report their key environmental data. More companies are doing so every year.

In a world with a rapidly increasing population and a growing middle-class, the pressure on finite natural resources necessitates that the corporate sector adapt to a more efficient use of natural capital for long-term profitability. Environmental data allows for quantitatively-driven analysis that complements other financial and performance indicators. As experienced investors, we believe that Environmental Productivity analysis is an essential investing tool for successful portfolio construction in the 21st century.

Investor Case Study: How Terra Alpha Investments Uses EP – Quantamental Process

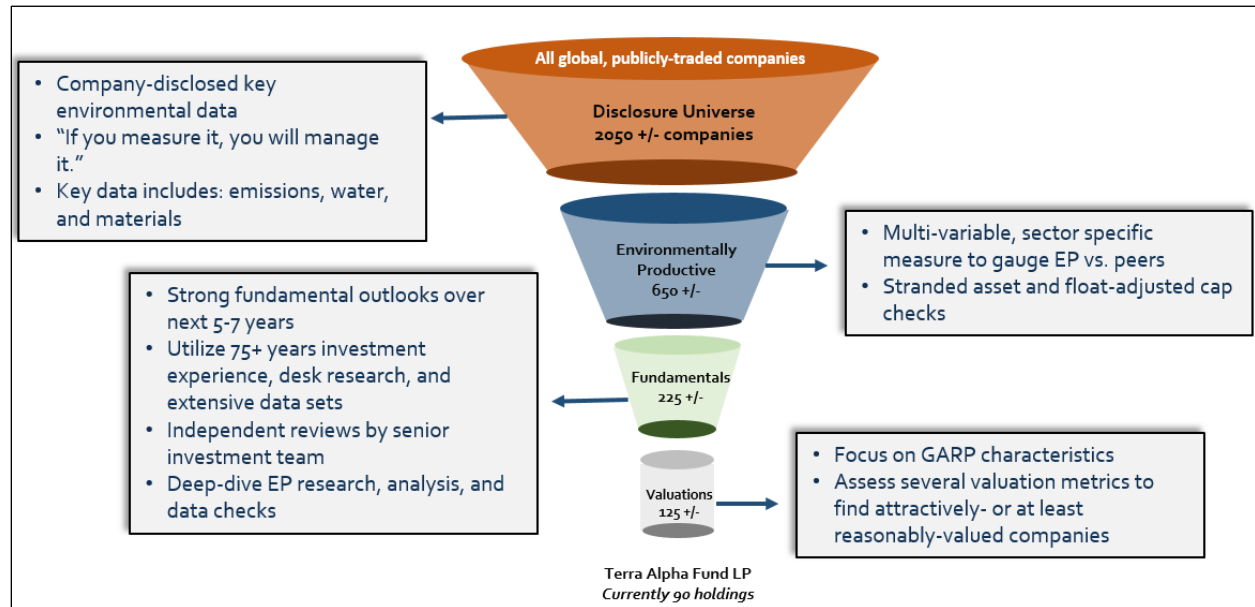
Environmental data is at the heart of the investor EP analysis. Though it should go well beyond the data to include forward-looking analysis. Corporate disclosure about environmental performance, as well as information about targets and plans, is critical to assessing EP.

As professional investors in global, publicly-traded companies, Terra Alpha's decision-making process begins with the data that companies disclose on their resource use. Using the company-provided data, Terra Alpha generates intensity measures and then identifies the most efficient users of carbon, water, and waste within peer sectors or subsector classifications.

After identifying the most environmentally-productive companies, Terra Alpha then utilizes traditional fundamental analysis which includes social and governance assessments, deep research into natural

Environmental data reporting by companies is a relatively new phenomenon, beginning in earnest in the early 2000s. However, due to greater regulatory, consumer and investor pressure, this practice has expanded rapidly over the past two decades. Over 2,000 publicly-traded companies disclosed their environmental data in 2016, including well over 70% of the market capitalization of the S&P 500 Index.

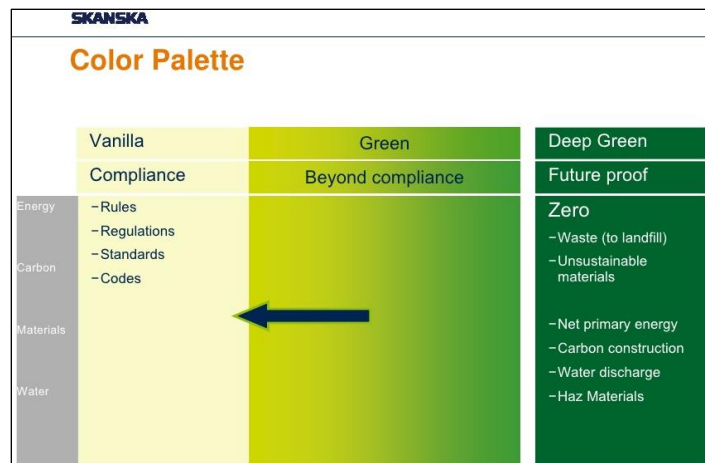
resource use and impact strategies, and valuation metrics to assess whether a company is a candidate for inclusion into the fund. The table below depicts the investment process.



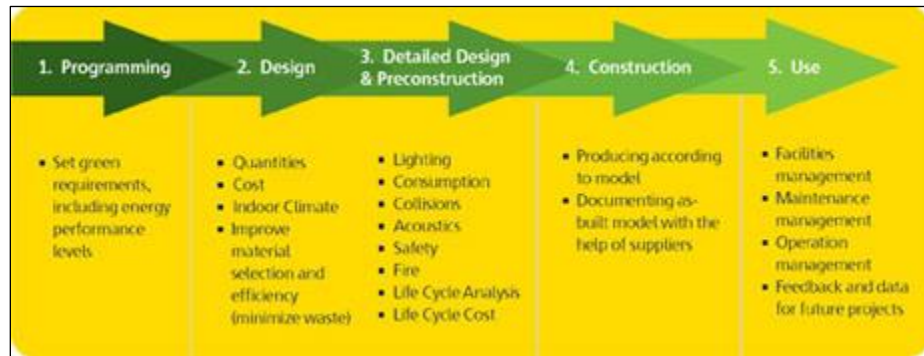
Business Case Study: How Skanska Has Integrated Environmental Productivity into Its Value Chain

Skanska is a forward thinking multinational construction and development company that has earnestly incorporated principles similar to Environmental Productivity throughout its organization's operations. Since 1997, the company has been publishing an Environmental Report that details the company's endeavors to improve its environmental performance, and since 2000, Skanska has certified all its operations to the international ISO 14001 environmental management standard.

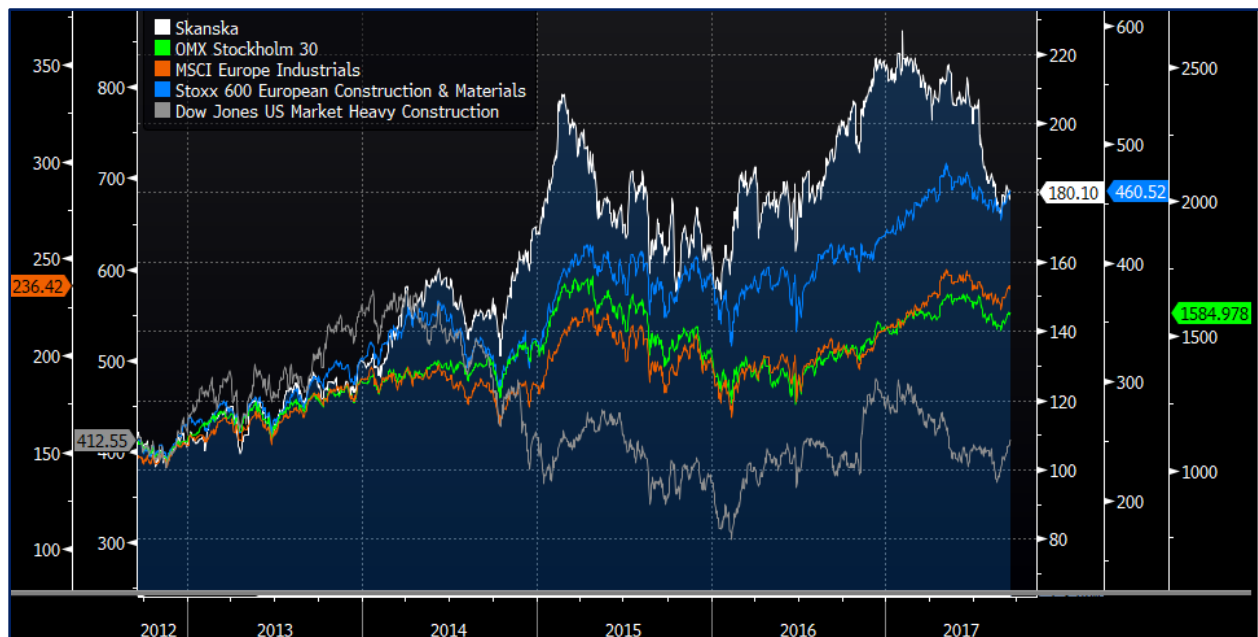
Currently, all business units across Skanska apply their Color Palette methodology to classify projects based on their environmental performance, set project targets, and report green revenue. Each business unit has an environmental plan fully integrated into its operations to increase both green performance and operational efficiency.



The company also uses a Building Information Modeling process and specialized energy modeling software to optimize the energy efficiency, carbon emissions, construction waste, and water use



during every phase of a project's life cycle (design, construction, and operation). These processes have allowed Skanska to help customers make increasingly informed decisions, deliver projects with greater [environmental and financial performance](#), and position themselves as a [pioneer in green construction](#). This commitment has also helped Skanska to outperform its local market, as well as several European and U.S. construction and industrial indices over the past five years.












(September 2012 – September 2017) Source: Bloomberg
















Conclusion

- The current global pace of natural resource consumption is unsustainable. Unchecked depletion of natural resources will have negative impacts for both businesses and investors who do not properly value efficiency in resource consumption.
- Evaluating a company's Environmental Productivity (the efficiency with which they consume natural resources) on material factors can help improve investment decisions and portfolio performance. This reality is being increasingly supported by a growing body of research.
- Environmental Productivity analysis is primarily a data-driven approach to analyzing how efficient companies are in managing consumption/generation of material environmental resources. A burgeoning body of organizations and regulations are creating, supporting, and mandating environmental disclosure. In addition, an increasing number of participating companies and investors are pushing this process into the mainstream.
- Including EP analysis in investment and business decisions can serve to improve the long-term returns for companies and investors alike.

Environmental Productivity is an additive analytical tool which business leaders and investors can use to better understand the risks and opportunities faced by their operations and can help to drive outperformance. GHG emissions, water, and waste are the primary metrics from which EP can be assessed; however, additional factors (e.g., forest and soil impacts) may soon be actionable, as well. Companies can benefit from measuring and managing their consumption of natural resources throughout their business, disclosing this information publicly, and working to improve their overall resource-efficiency. Investors can enhance their returns by integrating Environmental Productivity-related opportunities and risks into their investment strategies.

Appendix A – Tools for Measuring and Evaluating Environmental Metrics

Targeted Toward Companies	Targeted Toward Investors	Measuring Tool	Disclosure Tool
	<u>Bloomberg</u>	Bloomberg	
Bloomberg, accessible through Bloomberg Professional software, has a robust ESG category of information for each company that discloses environmental, social, and governance information.			
	<u>CDSB</u>		
Climate Disclosure Standards Board (CDSB) is an international consortium of business and environmental NGOs. They offer companies a framework for reporting environmental information with the same rigor as financial information. This framework helps CDSB to provide investors with decision-useful environmental information via the mainstream corporate report, enhancing the efficient allocation of capital.			
	<u>CDP</u>		
CDP's annual climate change & supply chain questionnaires collect company data on companies operational and supply chain carbon footprint. CDP has the most comprehensive collection of self-reported environmental data in the world. Their network of investors and purchasers represents over \$100 trillion, along with policy makers around the globe.			
	<u>Global Reporting Initiative (GRI)</u>		
GRI is an independent, international organization aimed at empowering decision makers to create a more sustainable economy. GRI's Sustainability Reporting Standards are one of the world's most widely used standards on sustainability reporting and disclosure.			
	<u>International Integrated Reporting Council (IIRC)</u>	INTEGRATED REPORTING 	
The IIRC works to develop the International Integrated Reporting Framework through which companies can report integrated information about strategy, governance, performance, and future prospects. The framework explains the underlying concepts behind integrated reporting and provides guidelines.			

Targeted Toward Companies	Targeted Toward Investors	Measuring Tool	Disclosure Tool
	<u>Sustainability Accounting Standards Board (SASB)</u>		
SASB provides industry-specific insight on which sustainability factors are most important to companies and most material for investors. Through these industry standards, companies can tailor sustainability initiatives to maximize value, while also disclosing information more effectively to investors.			
	<u>Task Force on Climate-related Financial Disclosures</u>		
The Task Force on Climate-related Financial Disclosures helps companies disclose their climate risk information in a clear and consistent way. It aims to highlight the financial exposure of companies to the risk of climate change. It is supported by the Financial Stability Board (FSB).			
	<u>Thomson Reuters</u>		
Thomson Reuters offers a comprehensive ESG database containing information on 4,000+ global companies and over 500+ data points, including all exclusion (ethical screening) criteria and all aspects of sustainability performance.			
	<u>Trucost</u>		
Trucost is a third-party data aggregator that combines environmental data disclosure from other disclosure sources as well as individual company reports.			
	<u>World Resources Institute (WRI)</u>		
As part of its engagement with companies and investors to help standardization, transparency and ease of environmental data reporting, WRI has helped establish a variety of tools and organizations that contribute to this cause. These include: Science Based Targets, Greenhouse Gas Protocol, Aqueduct and the Food Loss and Waste Protocol.			

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- ⁶ <http://www.sseinitiative.org/data/fact-sheets/>
- ⁷ <https://www.ceres.org/investor-network/incr/sustainable-stock-exchanges>
- ⁸ Scope 1: All direct GHG emissions; Scope 2: Indirect GHG emissions from consumption of purchased electricity, heat or steam; Scope 3: Other indirect emissions, such as the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity, electricity-related activities (e.g. T&D losses) not covered in Scope 2, outsourced activities, waste disposal, etc.
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