



# VALUES

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## Walden Asset Management

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## INCOME INEQUALITY: WHERE OCCUPY WALL STREET GETS IT RIGHT

Whether you view the Occupy Wall Street (OWS) protestors as passionate idealists or an unruly nuisance, they have dramatized the contrast between the financial rewards showered on Wall Street's leaders and the current state of the economy. The basic facts regarding income inequality, heretofore disputed by some skeptics, would now seem to be incontrovertible given the exhaustive study published recently by the nonpartisan Congressional Budget Office (CBO). Indeed, might it be fair to claim that our land of opportunity for all has become the outstanding developed world example of extraordinary opulence for the few—popularly identified by the OWS movement as the “1 percent”?

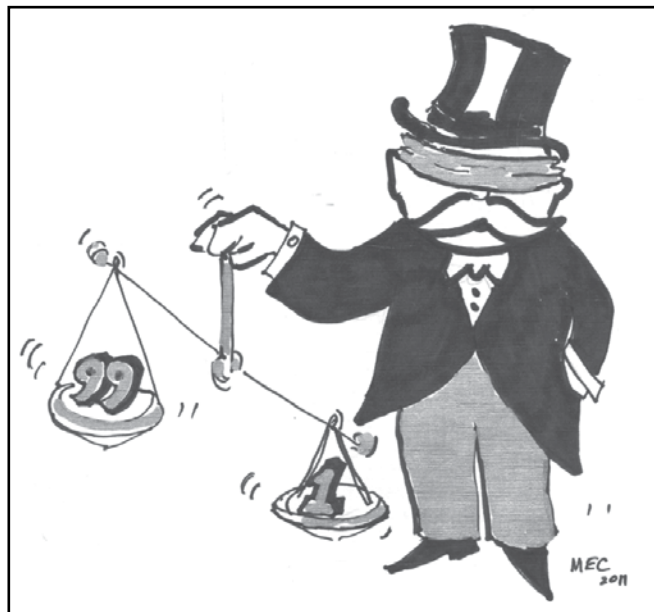
Here are a few highlights: In 1979, the top 1 percent of households accounted for 7.7 percent of total after-tax income, including transfer payments. In 2007, just before the onset of the financial crisis, the top 1 percent accounted for 17.7 percent of such income. Their 10 percentage-point gain in share was mirrored by a corresponding loss by the bottom 80 percent of households. Over that same 28-

year period, those fortunate few experienced inflation-adjusted income growth of 277.5 percent, well ahead of the 125.7 percent growth in gross domestic product (GDP). Meanwhile,

median family income grew just 34.8 percent and none of the other income groupings tracked by the CBO managed to keep pace with overall economic growth. In fact, the lower the income bracket tracked, the smaller the growth in income. By 2007, the income of the average household within the privileged 1 percent was more

than 20 times that of median. The corresponding figure in 1979 was less than 10 times the median.

The CBO report didn't include an assessment of the top 0.1 percent—the most fortunate 150,000 families in the country. But according to a detailed academic study based on tax records (Thomas Piketty and Emanuel Saez), this sliver of the population averaged about \$4 million in 2007 taxable income, or nearly 100 times the median. The bulk of the rise in incomes in the top 1 percent can be attributed to this tiny subset, especially during the past 10 years. CEOs of major public corporations, Wall Street titans, hedge fund managers, professional athletes, and



## About Walden Asset Management

Walden Asset Management has been a leader in integrating environmental, social and governance (ESG) analysis into investment decision-making and company engagement since 1975. A division of Boston Trust & Investment Management Company, Walden manages accounts tailored to meet client-specific investment objectives and works to strengthen corporate ESG performance, transparency and accountability.

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# THE IMPORTANCE OF BEING EARNEST ON LOBBYING DISCLOSURE

A series of questions with Tim Smith, Walden's Director of ESG Shareowner Engagement, by Kim Gluck.

**Walden: Why is the issue around corporate campaign financing and lobbying so important and timely in 2011-12?**

**Tim Smith:** The upcoming presidential election will create a huge buzz around political spending and lobbying, regardless of whether the spending is by a company or a union. Companies have a right to participate in the political process, but we believe that shareholders have a right to understand how company resources are being used to impact both elections and public policy, and if these resources are being used in the long-term interests of the company. Further, boards of directors have a fiduciary obligation to understand and evaluate the risks of both political spending and lobbying.

Although many companies are being more transparent about their political spending by voluntarily posting information on their websites, very few also disclose lobbying expenditures and priorities on their websites. Since there is reputational risk to a company if misguided lobbying efforts come to light, Walden, along with dozens of other investors, is actively calling for transparency on this issue.

**Aren't companies already required by law to disclose their lobbying?**

**TS:** Under the Lobbying Disclosure Act, companies are required to file quarterly reports showing the dollars spent on lobbying, the lobbyist name, year in which the lobbying was

done and the lobby topic. The Senate maintains a database that can be accessed to determine whether a company has filed quarterly lobbying reports. We downloaded a report on Pfizer that showed since 1999, this company had lobbying expenditures of about \$155 million (averaging about \$13 million per year)<sup>1</sup>. However, such reports are not easily found by investors, do not provide full detail, and typically do not disclose lobbying via third parties or grassroots lobbying. Further, there is no consistent disclosure requirement at the state level. States have a patchwork of different regulations on lobbying that do not give investors a complete picture.



Tim Smith, Director of ESG Shareowner Engagement, discusses corporate lobbying with Portfolio Manager Kim Gluck.

**What are we seeking for an outcome?**

**TS:** We are urging companies to disclose their lobbying, including work done through third parties such as trade groups or nonprofits. We also request information on the decision-making process and oversight of the lobbying program by the management and board. If companies are not receptive, Walden and other investors are filing shareholder resolutions to encourage companies to engage on this topic.

**How are companies using third parties, such as trade groups, to lobby and influence public policy?**

**TS:** Often a company will lobby directly through its own government affairs office, but it may also lobby through trade groups and nonprofit organizations. An example of the latter is the American Legislative Exchange Council, or ALEC. ALEC claims to be nonpartisan but its tagline is very telling: "Limited Government,

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# THE INTERFAITH CENTER ON CORPORATE RESPONSIBILITY (ICCR)

## *partnerships at work*

*This column highlights selected groups and organizations working to promote social and economic justice, environmental leadership, or corporate accountability. Walden often collaborates with featured groups and partners in research and advocacy initiatives.*

Imagine sitting in an audience full of investors, advocates, and corporate leaders as Paul Neuhauser, the attorney who drafted the first anti-apartheid shareholder proposal more than 40 years ago, steps up to the dais. As the ICCR community gathered at South Street Seaport this September to celebrate its 40<sup>th</sup> anniversary, members, friends, and supporters took stock of our accomplishments and reflected on the challenge of shaping the much-needed new age of corporate responsibility.

Paul described his awakening as a young law student when he asked Sam Wiley, then rector of The Church of the Advent in Boston, “Why doesn’t the Church do more about opposing segregation?” The stunning response he received from the Rector was simply: “YOU are the church.” Paul characterized that moment as life defining and second only in importance to marrying his wonderful wife. In the earliest days of shareholder advocacy, Paul played a major role in creating the movement known today as corporate social responsibility (CSR). Paul also reminded us of the many names of the movement’s earliest founders, including Tim Smith, now Walden’s Director of ESG Shareowner Engagement, who as ICCR’s former executive director provided inspiring and active leadership in the role I now hold. The room shifted from reverent silence to laughter and sudden bursts of applause as everyone was deeply moved by Paul’s remarks about four decades of faithful advocacy.

Today, the ICCR community includes 300 institutional investors with greater than \$100 billion in invested capital. What has defined us from our inception, and continues to distinguish our work from other investor

coalitions, is our social justice focus. A case in point is our emerging strategic emphasis on the human right to water. In the face of growing water scarcity globally—more than one billion people currently do not have adequate access to this life-sustaining natural resource—we are encouraging multinational companies to recognize and act on their responsibility to help ensure that all people have adequate, safe, and affordable water. PepsiCo commented recently on our water engagement collaboration:

ICCR has been an important stakeholder for PepsiCo, particularly the expertise of the UUSC [Unitarian Universalist Service Committee] and their partnership as we navigate and activate our public commitment to respect water as a fundamental human right.

*(ICCR’s 2010-2011 Annual Report)*

As I write I am looking out at the Hudson River from our offices here in New York City—the view is breathtaking as the days grow shorter and the last autumn leaves cling to the trees. Here at the Interfaith Center on Corporate Responsibility we are all getting ready for the holiday seasons of gratitude and light. We are especially grateful for this year of celebration. And yet we never forget that there is still so much work to be done. For 40 years, ICCR has been a pioneering coalition of active investors who have seen the result of their enduring record of corporate engagement time and time again. Through its shareholder engagement work across a wide variety of environmental, social, and governance issues, Walden has been a part of ICCR’s long-standing influence on corporate policies promoting justice and sustainability in the world.

In the course of 40 years, the CSR movement has also developed into a serious field. The demand for “green,” “fair trade,” and “ethically sourced” products helps drive that growth. Equally important, however, are the

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Laura Berry is Executive Director of the Interfaith Center on Corporate Responsibility (ICCR). For more information on ICCR, visit [www.iccr.org](http://www.iccr.org).



## RESEARCH & ENGAGEMENT IN ACTION



Marcela Pinilla is an  
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No one can know the longevity or specific direction of Occupy Wall Street (OWS) and its many spin-off demonstrations. Yet, the movement has succeeded in energizing a national discussion about the consequences of rising income and wealth inequality and the shortcomings in U.S. economic and political systems that have contributed to this gap. Despite our place in the Wall Street arena, Walden and like-minded investors share common ground with OWS, expressed through our engagement on corporate environmental, social, and governance (ESG) performance and accountability. Our initiatives addressing corporate influence in the political process, excessive executive compensation, fair lending practices, international labor standards and human rights, and environmental sustainability, among others, coincide with the central economic and social justice concerns voiced by OWS's 99 percent.

In 2012, corporate electioneering funds are expected to shatter previous records, thanks in part to the U.S. Supreme Court's *Citizens United* decision effectively allowing unlimited corporate money in politics. Building on success in previous years, Walden continues to lead shareholder campaigns encouraging political spending transparency and accountability, including resolutions at **Accenture**, **Deere**, **IBM**, **PepsiCo**, and **State Street** for 2012 annual meetings. Walden withdrew the resolution at Accenture when the company agreed to post on its website its political spending policies, which sensibly prohibit direct corporate expenditures and indirect use of trade association membership dues for political purposes. Moreover, in September Walden wrote to more than 40 companies seeking comprehensive disclosure of lobbying expenditures and policies including direct, indirect, and grassroots lobbying of legislators and regulators at the local, state, and federal levels (see *The Importance of Being Earnest on Lobbying Disclosure*, page 2). As part of a larger shareholder initiative, Walden has filed a new lobbying disclosure resolution for 2012 annual meetings at **3M**, **ConocoPhillips**, **Johnson & Johnson**, **JPMorgan Chase**, **State Street**, and **UPS**.

Walden's multi-year leadership in support of the shareholder advisory vote on executive compensation, popularly known as "Say-on-Pay," became a reality

with the passage of Dodd-Frank in 2010 that included a Say-on-Pay mandate. To continue encouraging greater accountability on executive compensation, including CEO pay relative to other executives and company employees generally, Walden is using Say-on-Pay proxy votes as a platform for more in-depth discussions. We recently had a candid conversation with **Umpqua**, for example, which was among the small minority of companies to receive a majority vote *against* executive compensation practices. When **Bottomline Technologies** reached out to us about our proxy votes in advance of its general meeting, we affirmed its compensation policies while also explaining our lack of support for a director nominee on its nominating committee due to a lack of diversity on the board.

Where continued weakness in the housing market is central to the ongoing U.S. economic malaise, the message of discontent from OWS and many others is loud and clear: Banks get bailed out but people lose their homes. Walden and other investors are pressing banks to report comprehensively on their loan modification processes and how they are attempting to make progress. With expert assistance from mortgage lending consultant CANICCOR, we are encouraging **JPMorgan Chase** and **PNC Financial** to ramp up efforts to avoid unnecessary foreclosures, including, as appropriate, reducing the principal owed as a means to lower monthly payments. Most recently, we are assessing the loan modification processes at **Ocwen**, among the largest servicers of subprime mortgages, to ensure that its good record on loan modifications can withstand the company's fast pace of growth through acquisitions of troubled loans.

Walden's engagement on economic and social justice issues is not confined to U.S. borders. When we learned recently of the temporary closure of Shanghai **Johnson Controls** by China's environmental authorities due to reports of lead poisoning in children living near the facility, we immediately followed up with the company. Johnson Controls, known for its strong environmental, safety, and health programs, asserts that contamination is not from its facility and that ongoing monitoring of employees shows no elevated blood-lead levels. Walden is continuing to follow this situation.

Walden's multi-year dialogue with **ConocoPhillips**, led by Boston Common Asset Management, addresses indigenous rights concerns associated with oil exploration and production in Peru. Together with representatives of the nongovernmental organization Amazon Watch, we have encouraged the company to adopt the best practice standard of free and prior informed consent. A breakthrough occurred in August when ConocoPhillips updated its official human rights position to be consistent with International Labour Organization Convention 169, concerning Indigenous and Tribal Peoples, and the United Nations Declaration on the Rights of Indigenous Peoples. This explicit recognition of indigenous rights provides a foundation for continuing discussion about energy development in Peru and other sensitive locations.

Environmental degradation and the looming scarcity of natural resources, such as water, may not be central to the OWS movement, but their connection to the economic divide is obvious. With nearly half of the world's population living in areas where water is either physically scarce or in short supply due to inadequate infrastructure, water intensive industries, such as agriculture and technology, may face significant water risk in their global supply chains. Walden and Trillium Asset Management led a resolution at **Sysco**, the largest U.S. food distributor, asking for an evaluation of its exposure to supply chain water scarcity. We withdrew the resolution upon Sysco's commitment to expand its sustainability strategy to address water scarcity and sustainable agriculture, and to complete in 2013 the Carbon Disclosure Project Water questionnaire, the leading repository for corporate data on water risk management. We filed a similar resolution at wireless technology company **Qualcomm** and a dialogue is underway.

Extended producer responsibility (EPR) shifts responsibility for managing post-consumer waste from individuals and governments to corporations. Led by As You Sow (AYS), Walden filed shareholder resolutions at **General Mills** and **Procter & Gamble** (P&G), asking them to study the feasibility of adopting an EPR policy that builds on their successful experiences in Europe and Canada. The General Mills resolution was withdrawn based upon the company's agreement to hold quarterly meetings with AYS and investors, sharing key data on packaging waste and EPR programs from other countries, including data on program costs and recycling and recovery rates. The P&G resolution was also withdrawn when it committed to a study evaluating EPR and other options in the United States to achieve its goal of zero post-consumer waste to landfills.

On an array of economic, social, and environmental justice concerns, Walden challenges companies to address actual and potential detrimental business impacts that are too often externalized to communities without a big voice. We are pleased to occupy this unique space on Wall Street.

—H. Soumerai

## Public Policy Advocacy and Collaborative Initiatives

While the theme of corporations' role in shaping politics and public policy dominates public discourse from the street to the executive suite, Walden continues to lead engagements and participate in investor collaborations urging sound legislation and regulation on ESG matters, as well as greater corporate accountability and transparency.

Since our last newsletter, Walden has:

- ◆ Supported a rulemaking petition to the SEC requiring corporate political transparency. The submission captures concerns of a large number of investors who lack uniform means to monitor and assess the risks of corporate political spending.
- ◆ Written President Obama urging a stand against efforts to weaken, defund, or delay the nascent Consumer Financial Protection Bureau, the agency born out of the Dodd-Frank law to protect consumers from abusive financial practices.
- ◆ Participated in an Investor Network on Climate Change-led signatory letter supporting a regional Clean Fuel Standard (CFS) in the New England and Mid-Atlantic states. A CFS would require fuel providers to gradually transition to a cleaner mix of energy sources for fuel.
- ◆ With Calvert Investments, written to dozens of companies with seats on the board of the U.S. Chamber of Commerce or the National Association of Manufacturers, asking them to tell their trade organizations to end their campaigns to stifle the EPA's ability to mitigate climate risk.
- ◆ Joined an Investor Network on Climate Risk letter to NYSE Euronext, parent of the New York Stock Exchange, to encourage increased ESG transparency among companies listed on the exchange.
- ◆ Encouraged, through industry collaboration, the Canadian federal and Alberta governments to work together for rapid and effective implementation of an enhanced environmental monitoring system in the oil sands region, to which the governments committed earlier in 2011. A total of 43 investors representing US \$1.7 trillion in assets participated in this sign-on letter.

Finally, Walden once again signed on to the 2011 Global Investor Statement on Climate Change, a joint statement representing 285 investors with more than \$20 trillion in aggregate assets. The Statement urges policy action that stimulates private sector investment in climate change solutions, creates jobs, and promotes the long-term stability of the global economy.

—M. Pinilla



celebrities are prominent members of this privileged stratum.

While this group of Americans prospered, how did those in the middle get by? Only the sharp rise of women in the workforce offset what would have been an even more dire predicament for households in the middle. Between 1979 and 2007, median real wages for men actually fell by 10 percent while the share of working-age men in the labor force gradually declined. In contrast, median real wages for women rose a positive but still modest 15 percent while their labor force participation steadily rose. Without this change in the contribution by women, middle-income families over this period would have experienced an absolute decline in their financial well being rather than the modest gains reported. Debt, of course, was the other piece of the puzzle. Year after year the rise in household spending outstripped the growth in income. By 2007 the combination of mortgage, student, and credit card debt per capita was sevenfold the level of 1979.

It is easy to dismiss the OWS phenomenon as an inchoate movement lacking focus and platform. Perhaps that's a fair assessment. But the issues OWS draws attention to should not be dismissed by those of us who believe that market capitalism is the single best form of economic organization, and the one most consistent with a free society. Indeed, the popular support of an economic system that allows for a wide range of individual financial outcomes rests upon two simple propositions. First, that it enables a sustainable path to rising prosperity. Second, that that prosperity will be widely shared. Americans have typically been more tolerant of greater income equality than citizens of other developed economies precisely because of the conviction that our brand of free market capitalism rewards hard work and merit.

Recent facts challenge these propositions. High unemployment, burdensome debt, slow economic growth,

and rising income inequality undermine the consensus that the system is working for most of us. If income inequality is understood to be the price we pay for the chance to improve individual economic well being, the CBO report finds we have been receiving less for that payment. During the past 30 years rising inequality has been accompanied by deteriorating mobility among income groups. Confounding popular perceptions that are as old as our republic, one study finds that the opportunity to improve one's financial fortunes is now greater in Europe than in America<sup>1</sup>. During the three decades following World War II, greater access to higher education was the path that lifted the fortune of ever more Americans. But this path has narrowed also. In the past 20 years, the share of college students coming from the highest income quarter of households has risen while the share from the lowest has declined.

From today's vantage point, three decades of declining tax rates for upper income households and financial deregulation, advertised as elixirs to energize our economy, would seem to have failed to improve the lot of the average family. For many, the financial crisis turned easy access to debt from a palliative for lagging income growth into one more roadblock on the path to a better standard of living. Rather than demonstrating the appeal of a system that rewards merit, the

spectacular gains in wealth by a few risk robbing the system of its legitimacy. Is there any wonder that Wall Street's leaders, perceived to be both the instigators and beneficiaries of these changes, are the most prominent targets of the OWS protest?

Surely, there is a tinge of the fanciful in the OWS movement. Fashioning a program to ensure that prosperity will be more widely shared is far more difficult than making the case that the 1 percent have prospered undeservedly. And it is disturbingly easy to conclude in anger that market capitalism itself is to blame. To the contrary, for 30 years following World War II, a newly regulated market economy with a safety net born of Depression-era reforms accompanied an unprecedented period of strong economic growth, financial stability, decline in income inequality, and upward mobility based on merit. The challenge today is nothing less than restoring a shared belief that this system can work for everyone.

—B. Apfel



Bill Apfel, EVP, is a Portfolio Manager and Director of Securities Research.

<sup>1</sup> <http://www.economicmobility.org/assets/pdfs/EMP%20American%20Dream%20Report.pdf>

## THE INTERFAITH CENTER ON CORPORATE RESPONSIBILITY (ICCR) *continued from page 3*

discriminating investors who buy stock in companies that are willing to work toward increasingly stringent standards of environmental, social, and governance accountability. Together we are empowered by the proliferation of organizations dedicated to promoting shareholder advocacy who envision the possibility of transforming corporate practices for the

common good. Their faith has inspired generations and their wisdom continues to guide ICCR.

As Nelson Mandela said, "After climbing a great hill, one finds many more to climb." Let us pause briefly at this 40-year summit to admire the view, and with a renewed sense of purpose, continue forward in partnership.

—L. Berry

## THE IMPORTANCE OF BEING EARNEST ON LOBBYING DISCLOSURE *continued from page 2*

Free Markets, Federalism.”<sup>2</sup>. ALEC is a conservative political group composed of corporations and elected state officials. ALEC drafts legislation that reflects a particular corporate agenda and offers it up as a model that can be sponsored by legislator members. While government officials are also members, 80 percent of the ALEC budget comes from corporations. There is deep secrecy around this organization as it does not disclose its membership nor are the bills that its members introduce connected to ALEC in any transparent way. We believe companies should explain how they try to change state and local legislation through ALEC.

Another area of concern is the lobbying done by groups such as the U.S. Chamber of Commerce, which purports to represent all of its members. Like ALEC, the Chamber has been an advocate for reduced regulation around environmental issues such as climate change and greenhouse gas emissions. However, this stance is inconsistent with many of its member companies’ commitment to sustainability and is likely not in their long-term business interests. For example, Accenture touts in its corporate citizenship report the fact that it

has made the Carbon Disclosure Project’s Global 500 Carbon Disclosure Leadership Index for the second time, even though Accenture is also part of the Board of the Chamber of Commerce.

### What companies are voluntarily reporting their lobbying and trade group spending?

**TS:** To date, only a few companies are disclosing information beyond what is legally required. The Center for Political Accountability (CPA) published a report in October 2011 showing that 57 of the largest 100 Standard & Poor’s companies disclose their direct corporate political spending and have board oversight, or they prohibit the use of corporate funds for the purpose of political spending. However, only 26 of those companies report the portion of their trade association dues that are used for political or lobbying purposes. As the CPA report notes, trade associations and tax exempt “social welfare” groups, known as 501(c)(4)s under federal tax law, can provide secret financing of elections as they are not required to disclose membership or donors. Further, the report says, “Corporations can make unlimited payments to trade associations and 501(c)(4)s. This funding poses a great risk that

companies will be unaware of how their money, passed through a conduit group, is spent for political purposes. It also poses a risk that a company’s payment could be leaked or inadvertently disclosed and could create problems for the company.”<sup>3</sup>

According to American Federation of State, County, and Municipal Employees (AFSCME), the Chamber and seven other large trade groups received in excess of \$1.3 billion in contributions in 2009. Tax records show that these groups used \$500 million of those funds on lobbying and other political activity. Thus, some large trade groups spend close to 40 percent of every dues dollar on “lobbying,” which, of course, is not tax deductible by the companies. We believe that shareholders would benefit from reporting, made available on companies’ websites, that discloses public policy priorities and explains board oversight of lobbying as a way to minimize reputational, regulatory, and other risks.

—K. Gluck

<sup>1</sup> [http://www.senate.gov/legislative/Public\\_Disclosure/LDA\\_reports.htm](http://www.senate.gov/legislative/Public_Disclosure/LDA_reports.htm)

<sup>2</sup> <http://www.alec.org/AM/Template.cfm?Section=Home>

<sup>3</sup> <http://www.politicalaccountability.net/index.php?ht=aGetDocumentAction/i/5800>, page 15



Congratulations to Tim Smith, our Director of ESG Shareowner Engagement, for recognition by the National Association of Corporate Directors (NACD) and inclusion on its 2011 Directorship 100. Each year NACD honors influential business leaders, governance advocates and regulators who work to advance best practices in corporate boardrooms. Tim’s relentless efforts on behalf of Walden’s clients to encourage greater director independence, responsiveness and accountability—through successful promotion of annual elections of directors, political spending transparency, “Say-on-Pay” reforms, sustainability reporting and much more—reverberates in boardrooms throughout the country.





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## VALUES

### *cutting edge companies*

## GT ADVANCED TECHNOLOGIES

*This column highlights companies in the business of providing solutions to social and environmental challenges. Featured companies are typically held in the Small Cap Innovations portfolios offered to Walden clients.*

While we hear often of the creative and inventive aspects of innovation—whether for an iPad or a robotic exoskeleton—it is worth a reminder that economics often drive an innovation's market success. Merrimack, N.H.-based GT Advanced Technologies (ticker: GTAT) is a company that drives the increased affordability of two important alternative energy technologies—solar and LED—through the increased efficiency of the equipment it manufactures.

**Solar.** GT's photovoltaic (PV) business segment manufactures equipment that produces polysilicon, the principal raw material in solar cells, and casts polycrystalline ingots, which are manufactured into PV wafers. GT is on its fifth generation of products, and efficiency is its main point of distinction among its peers. GT reports its most recent reactor is 50 percent more efficient than previous generation reactors, and GT is developing a reactor to improve energy efficiency by an additional 30 percent. Annually GT produces units with aggregate PV manufacturing capacity close to 1 gigawatt (GW), roughly equivalent to the power consumption of 1 million U.S. households. World solar demand was 16 GW in 2010, up nearly 80 percent over the previous year.



Ken Scott, Portfolio Manager and Securities Analyst, leads the Small Cap strategy.

**Sapphire/LED.** GT also manufactures advanced sapphire crystal growth (ASF) systems that incorporate technology originally developed for its PV business. Sapphire crystals are critical to superior performance of blue and white LED, a technology that relies on electroluminescence to use significantly less energy in lighting and electronic devices. LED light bulbs use 85 percent less energy per watt than incandescent bulbs, and less energy than compact fluorescent lamps (CFLs) as well. LED bulbs reach full brightness instantly (unlike CFLs), have comparable lighting performance (softness or coolness) to incandescent bulbs, and reportedly last 20 years, but generally cost at least \$20 per bulb. Thus, continuing to lower the initial cost of LED bulbs is key to improving consumer acceptance. GT entered the sapphire business in 2010, and delivered its first ASF system in May 2011. GT reports its crystal growth systems provide LED makers with sapphire production efficiency benefits of 30 percent relative to peers. GT is enabling larger sapphire wafer sizes (currently 6") with its next generation (8") in development.

GT is the market leader in equipment to make inputs for solar wafers and LEDs, and has on average nearly doubled its revenues each year since 2004. While this growth rate will inevitably taper off, and GT is unlikely to make headlines, its customers depend on the firm to manufacture ever-more efficient equipment to lower manufacturing costs, so that all may experience the benefits of solar PV and LED.

—K. Scott