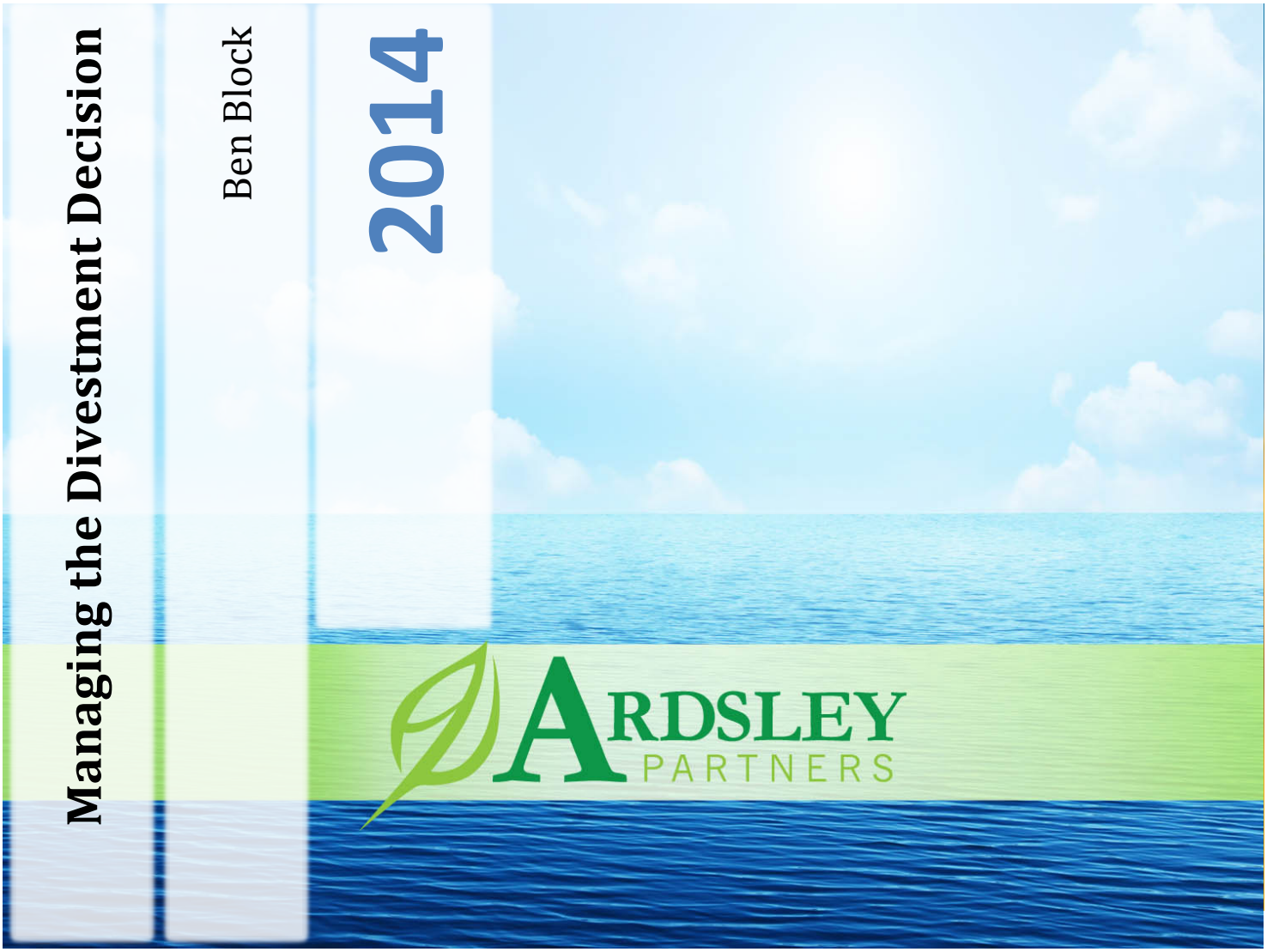
Managing the Divestment Decision

Ben Block

2014



As institutions face pressure to divest their portfolios of fossil fuel emitters, important questions arise about how to replicate the returns of one of the largest and strongest-performing segments in the global equity universe. We examine this issue from the lens of our normal macroeconomic screening process, and suggest that the fossil energy industry will face considerable macroeconomic headwinds over the coming decades, justifying a pragmatic approach to divestment on economic terms. We further examine options for reinvestment of these proceeds, and recommend investors maintain exposure to the overall energy sector through a sensible portfolio of alternative energy equities.

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As we have hit the road to talk to investors over the past few months, one of the common themes that has come up is the pressure being exerted upon asset allocators to divest their holdings of fossil fuel emitters. Among the more publicized of these efforts is 350.org's "Go Fossil Free" movement, a series of grassroots campaigns that encourage major universities, governments, and religious institutions to rid their portfolios of the world's 200 largest fossil fuel reserve holders.

While we have our own personal views on these divestment campaigns, we try to exclude them from our investing process – after all, our fiduciary duty is not to be green, but rather to make green. But we do think the topic has very important financial/economic implications given the sheer size of the energy sector relative to the overall global economy. And so we thought we'd take a few pages to articulate the challenges and opportunities faced by would-be divesters.

The 200 companies ("Top 200") referenced by 350.org have an aggregate market capitalization of $4.5 trillion (USD), or nearly 14% of the $32 trillion in market capitalization of the MSCI World Index. [1] [2] Thus, for the typical university endowment with 36% invested in equities, a portfolio manager contemplating divestment would be forced to re-allocate ~5% (=14%*36%) of AUM. [3]

While a 5% re-allocation decision is enormous, it is complicated further by the fact that the divestment would come from one of the best performing sectors in the global equity portfolio over the past decade. From our fund's launch date of 6/30/2006 until 3/31/2014, the Top 200 returned an annualized 9.6%, versus just 5.8% for the widely-used MSCI World Index. So, after stripping out the contribution from the Top 200, the MSCI World Index return drop to just 4.3% annually.

We underscore this point: *if institutions would have divested the Top 200 Emitters from their portfolios in 2006 and reinvested this into the non-fossil components of the global equity universe, they would have lost 1.5% of equity performance per year!* Thus, it is understandable why endowments such as Harvard University have so vociferously protested divestment, writing: "logic and experience indicate that barring investments in a major, integral sector of the global economy would […] come at a substantial economic cost."[4]

Ardsley Partners will soon be celebrating its 27th anniversary of continuous operations – no small feat in these turbulent investment climes. While we owe much of our success to sound fundamental research on individual stocks, we have also managed to institutionalize several basic investing rules that help direct our top down filter on industry trends. Three of these rules that are particularly apropos of this discussion are:

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[1] Many of these companies have been acquired since 350.org originally published its list. For calculation purposes, we include the acquisition value in the overall market cap calculation. All data available upon request.
[2] MSCI World Index Fact Sheet, 2014
[3] Asset Allocations for U.S. Colleges and Universtity Endowments and Affiliated Foundations, 2013
[4] Letter to Members of the Harvard Community, October 2013

(1) Avoid companies with rising cost structures; buy companies with falling cost structures
(2) Sell market share losers; buy market share gainers
(3) Skate to where the puck is going to be

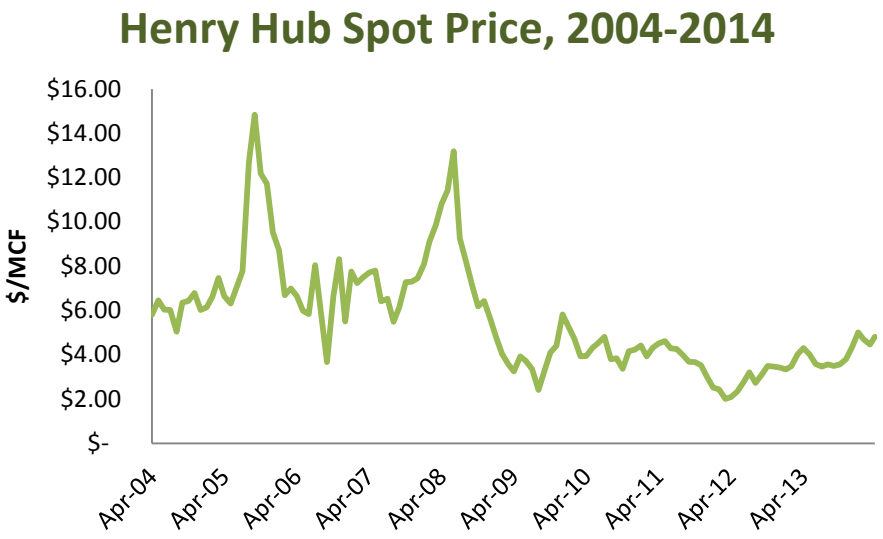
While our analysis of the historical results of divestment suggest otherwise, these three maxims contradict past performance data strongly enough that we must argue in favor of divestment. In doing so, we will suggest that the fossil energy industry now faces structural challenges that will act as headwinds over the coming decades, and we believe that there is sufficient cause for divestment on a purely economic basis.

But the conclusions from our rule-based analysis do not end there. Instead, we suggest that allocators take the proceeds from divestment, and rather than redistribute them back into the standard global equity portfolio, we advise that they move them into a sensible portfolio of alternative (non-fossil) resource companies.

So let us discuss these recommendations in greater detail:

Investing Maxim #1: Avoid companies with rising cost structures; buy companies with falling cost structures

While there is a popular perception that hydraulic fracturing, or "fracking," has dramatically lowered the cost of extracting hydrocarbons from the ground, this is only a partial truth. In reality, the cost reduction: (1) only applies to North America; (2) only applies to natural gas; and (3) has been vastly overstated by a news media fascinated by the concept of "energy renaissance."



Source: Bloomberg Data

The graph above tracks Henry Hub natural gas pricing over the past decade. And indeed, it has dropped from $5.76 to $4.79. While a 17% price drop is significant, it does not exactly support

the notion that we are in a 'golden era' of cheap gas. Instead, we believe that the price spikes of 2005 and 2008 have helped to anchor this perception.

What is more interesting is that most independent studies of fracking economics suggest that cheap gas may only be a short-term phenomenon. According to Ken Medlock of Rice University's Baker Institute of Energy studies, the median fracked well in the US requires a $4.85 price to break even, suggesting that the majority of current wells are not profitable (and E&P companies are only drilling to maintain their lease rights).[5] Furthermore, Medlock implies that once the highly productive wells are depleted, gas prices will need to rise once again in order to stimulate production in second-tier wells with higher extraction costs.

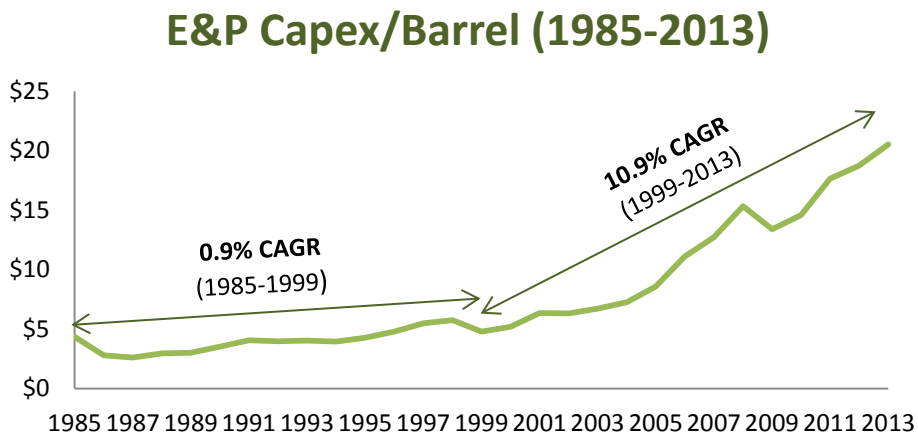
We note that, while gas prices have indeed declined, it has not led to a drop in electricity prices in the US. According to the Energy Information Association, average retail electricity prices have increased from $76.10 to $98.40 per megawatt-hour during this "energy renaissance." Most of this has been driven by increased costs to deliver the fuel customers.

The rest of the global energy sector has not been as lucky as U.S. gas producers, having seen skyrocketing costs in discovering and developing new reserves. The coal industry, for example, has been decimated by rising costs. According to the International Energy Agency, global coal mining costs have risen by 9% a year since 2005,[6] driven principally by increases in labor, equipment, transportation fuel, and electricity.[7] There is perverse irony in these latter two cost categories: rising costs of *purchasing* fossil fuels are causing rising costs in *extracting* fossil fuels. That is called a vicious cycle.

Unfortunately for coal producers, particularly in North America, they have been unable to pass on these rising costs to consumers due to the prevalence of natural gas as a competitive fuel. The results of investments in these companies have been tragic: over a half dozen leading coal companies have gone bankrupt, and the three largest North American coal producers (nearly 50% of the United States' production) have lost 63% of their market cap since 2005.[8]

We believe that the demise of coal equities should serve as a cautionary tale for investors in oil producers. One of the more eye-opening charts that we've seen over the years is shown below. This chart, adopted from a Barclays Research study, shows that from 1985 to 1999, the costs incurred by oil majors to replace their reserves was effectively flat. Then, starting in 1999, costs exploded: the largest industry on earth started to experience 10.9% annual production cost increases!

[5] Anderson, Jared. How Much Does a Shale Gas Well Cost? 'It Depends.' *Breaking Energy*, August 6, 2013
[6] Muffson, Steven. Cost of mining coal continues to climb. *Washington Post*, October 24, 2012
[7] Cost Trends in Mining, Marston, May 2008
[8] Source: Bloomberg, Ardsley analysis

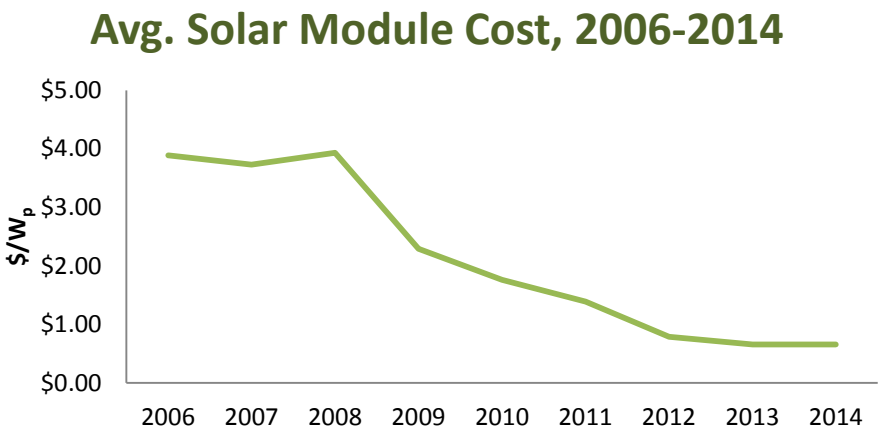


Source: Barclays Research, International Energy Agency

The reasons for this cost increase are many. Among the most easily explainable are (1) the world's "easy" oil has already been extracted, and new oil finds have been from "tight" oil, oil sands, or deepwater drilling; (2) oil companies have been forced to explore in politically unstable geographies like Venezuela, Argentina, or Nigeria, and thus face higher costs of capital; and (3) environmental fallout from the Macondo Spill and other disasters has increased safety-related capital expenditures across the board. Chevron's CEO, John Watson, summed up his industry's predicament in a recent speech: "$100 a barrel is becoming the new $20 in our business… costs have caught up to revenues for many classes of projects." [9]

Whatever the reasons for the cost growth: the conclusion is zero-sum: oil majors either need to pass on higher costs to consumers, or they will start making less money. Watson, in the same speech, offered us his prediction, "If $100 is the new $20, consumers will pay more for oil."

But there is actually a small-but-growing part of the energy sector where costs are declining.



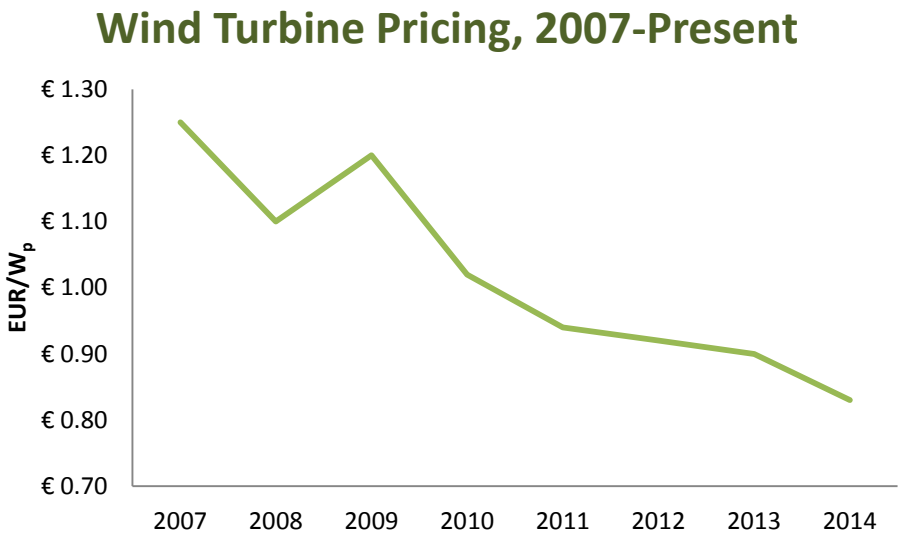
Source: Public Company Filings, Ardsley analysis

[9] The New Reality in Oil and Gas Business, *US Oil and Gas Monitor*, March 17, 2014

When we launched our fund in June 2006, solar panels cost nearly $4.00 per watt. Since then, these costs have fallen by nearly 80% (see chart above), accompanied by dramatic improvements in product quality and efficiency. Looking into the future, we expect a similar cost curve: Greentech Media Research recently released a study suggesting that manufacturers actually expect *acceleration* – to a 10.3% annual cost decline – for the next three years.[10]

We are perhaps even more optimistic about the potential for reductions in the "soft" costs of solar installations. In Germany, for example, it costs less than half to install a residential solar system than it does in United States. A February 2013 Lawrence Berkeley National Lab study suggests several reasons for this cost delta, but most center on the maturity of the market and the associated business process costs that come with more installation experience.[11] With that in mind, we expect massive declines in these costs over the coming few years.

Similarly, wind turbine manufacturers have experienced dramatic cost decreases. For the past two decades, the average cost per kilowatt-hour of wind has declined steadily by 14%. This cost decline has accelerated for the past four years, with the average unit price per turbine falling by 28% annually, with massive gains in both efficiency and availability.[12]



Source: Bloomberg, Ardsley analysis

For both solar and wind, the price declines in the up-front equipment costs are exciting, but the biggest source of cost decline has actually been in financing costs. As investors have become more and more comfortable with the risks involved with these projects, the borrowing costs for project developers has fallen precipitously. Earlier this month, for example, the solar firm

[10] PV Technology Cost Outlook, 2013-2017, *Greentech Media Research*, 2014
[11] Why Are Residential PV Prices in Germany So Much Lower Than in the U.S.?, Lawrence Berkeley National Laboratory, Feb. 2013
[12] Source: Bloomberg New Energy Finance

SolarCity sold an asset backed security for 4.59%. While this is still pricey compared to comparable fossil fuel debt, it is a huge decrease in financing costs from even 12 months ago.

Nor are these cost declines unique to wind and solar. LED lighting producers have been on very similar steep decline curves, with cost per lumen falling by ~20% per year since 2005; the US Department of Energy projects these costs to fall another 85% by 2020.[13] Battery producers, the enabling technology behind electric vehicles, have seen a 9.9% annual manufacturing cost decline for the past two decades.[14]

While we acknowledge that these cost reductions have come off of a high base, the result is unequivocal: there are – *today* – parts of the world where renewable energy sources are more cost competitive than their fossil competitors. And if that is the case now, then more and more markets will open up when the anticipated cost trends (in both directions) are observed.

With all due respect to Chevron's Mr. Watson, if we learned anything in our MBA economics classes, it's that when prices for commodities go up, consumers always (eventually) respond by using a different commodity (or using less of that commodity). And that's a good segue for our next maxim.

Investing Maxim #2: Avoid market share losers; Buy market share gainers

As we stated above, there are regions of the world where, today, certain forms of alternative energy are economically viable with no incentive or regulation. By and large, these regions either: (1) lack energy and utility infrastructure (rural Africa and India); (2) must import expensive fossil fuels (island regions like Japan, the Caribbean, and Hawaii); (3) have shortages of fossil-derived energy created by NIMBYism and/or geography, combined with surpluses of alternative energy (sunny/windy regions of California, Southern Europe, etc).

Nevertheless, as alternative energy costs continue their decline, the prevalence of these economically-viable regions will inexorably expand, and there will be acceleration away from fossil fuel and into alternative energy sources.

In addition, there are huge parts of the globe where governments have strong strategic and geopolitical motivations to develop alternative energy. It is no accident, for instance, that Germany was the largest renewable energy market in the world for most of the past decade. Germany has long dealt with Russia as a supplier of over 30% of its natural gas, with nearly half of this flowing through Ukraine.[15] For obvious reasons, Germany has sought fuel supply diversity, and the advent of cheaper solar and wind-based generation technologies served as a

[13] Solid-State Lighting R&D Manufacturing Roadmap, United States Department of Energy, Sept. 2013
[14] Anderson, David. An Evaluation of Current and Future Costs for Lithium-Ion Batteries for Use in Electrified Vehicle Powertrains. May 2009
[15] European Energy Markets Observatory, Capgemini, 2013

key enabler of this shift. As a result, renewables have increased steadily as a percent of German electricity generation from just 6% in 2000 to 19% in 2013.[16]

The renewable energy boom in Germany has also created its share of losers, most notably in the market share loss sustained by the fossil-heavy utilities RWE and E.ON. As the 35 gigawatts of solar generation capacity ate into peak load, German utilities were forced to take their natural gas and coal plants offline more frequently. According to the consultancy Capgemini, average German natural gas plant utilization fell to just 21% in 2013, far below the 57% level they need to stay profitable. As a result, RWE has lost 60% of its market cap in the past 8 years, and E.ON has lost 55%.[17] This is a stark example of why investors should avoid market share losers.

As US utility analysts and investors watch this situation play out in Germany, there has been much ink spilled about the coming "utility death spiral" in the United States. Similar to Germany, the United States has recently experienced a boom in residential solar installations, particularly in California where poorly designed regulations have conspired to keep energy prices exceedingly high. To stem their market share loss, utilities across the country have launched a massive regulatory fight to halt the spread of solar from cutting into their rate-paying base of customers. In late 2013, California passed a state law giving utilities the right to assess a small surcharge to users of solar energy. Earlier this year, the Arizona Public Service Commission made a similar decree. Unfortunately for California and Arizona's regulated utilities, most industry analysts concede that these policy responses will not slow the rising market share for residential solar in the United States.

As a result, more progressive utility CEOs are taking it upon themselves to reallocate their own portfolios to align with these inevitable trends. David Crane, the luminary CEO of NRG Energy (the largest U.S. fossil generator), recently called distributed solar a "mortal threat to [the utility] business."[18] To stem this market share loss, he recently acquired Roof Diagnostics Solar, the United States' eighth-largest solar installer. In a statement, Crane admitted the market share loss faced by his core business by saying: "With the price of residential solar increasingly competitive with the retail price of power in multiple states, the time is now for NRG to ramp up its efforts to bring the benefit of self-generation to NRG's millions of […] customers."[19]

Developing markets are facing the same market share rebalances, though for different reasons. China, for example, is a fascinating case study that will have massive implications for global energy market share. It is well known that much of eastern China is facing disturbing air and

[16] Electricity Production from Solar and Wind in Germany in 2013, Fraunhofer Institute, January 2014
[17] Source: Bloomberg, Ardsley analysis
[18] Chernova, Yuliya. Utilties Facing a 'Mortal Threat' From Solar. *Wall Street Journal,* March 25, 2013
[19] NRG Energy, NRG Acquires Rood Diagnostics Solar [press release], March 2014

water pollution problems that have created high rates of lung disease and growing malaise amongst Chinese citizens. Facing social unrest, Beijing has been called to action.

China Primary Energy Usage by Fuel Type, Actual and Projected

	Oil	Nat. Gas	Coal	Nuclear	Hydro	Solar	Wind	Geo/Bio
1980	20.5%	3.1%	73.3%	0.0%	3.2%	0.0%	0.0%	0.0%
1985	16.9%	2.2%	76.9%	0.0%	3.9%	0.0%	0.0%	0.0%
1990	17.0%	2.1%	76.6%	0.0%	4.3%	0.0%	0.0%	0.0%
1995	18.1%	1.8%	74.8%	0.3%	4.9%	0.0%	0.0%	0.1%
2000	22.9%	2.2%	69.3%	0.4%	5.1%	0.0%	0.0%	0.1%
2005	20.5%	2.6%	70.5%	0.8%	5.6%	0.0%	0.0%	0.0%
2006	19.9%	2.9%	70.9%	0.7%	5.6%	0.0%	0.0%	0.0%
2007	19.7%	3.4%	70.3%	0.7%	5.8%	0.0%	0.1%	0.0%
2008	19.1%	3.7%	69.5%	0.8%	6.7%	0.0%	0.2%	0.0%
2009	18.5%	3.8%	70.0%	0.8%	6.6%	0.0%	0.3%	0.0%
2010	18.7%	4.1%	68.9%	0.7%	7.0%	0.0%	0.5%	0.1%
2011	18.1%	4.6%	69.3%	0.8%	6.2%	0.0%	0.7%	0.3%
2012	17.7%	4.7%	68.5%	0.8%	7.1%	0.0%	0.8%	0.3%
2013	17.4%	5.0%	68.1%	0.9%	7.1%	0.1%	1.0%	0.4%
2014E	17.1%	5.3%	67.5%	1.0%	7.4%	0.1%	1.2%	0.4%
2015E	16.9%	5.8%	66.6%	1.1%	7.8%	0.2%	1.3%	0.4%
2016E	16.6%	6.3%	65.7%	1.3%	7.9%	0.2%	1.5%	0.4%
2017E	16.4%	7.0%	64.5%	1.5%	8.1%	0.3%	1.7%	0.4%
2018E	16.2%	7.9%	63.0%	1.7%	8.3%	0.4%	2.0%	0.4%
2019E	16.0%	9.0%	61.2%	2.0%	8.6%	0.5%	2.3%	0.4%
2020E	15.9%	10.3%	58.7%	2.5%	8.9%	0.7%	2.7%	0.4%
'20/'12 %Δ	-1.5%	5.3%	-9.4%	1.6%	1.7%	0.6%	1.6%	0.0%

Source: BP, ISI Research

In its 12th Five-Year Plan, Beijing prioritized a reduction of fossil consumption as laid out in the table above. These targets include a 1.5% reduction in the share of oil, and a staggering 9.4% reduction in the share of coal. As China consumes roughly 22% of the world's energy, this represents a 0.3% and 2% market share loss for these two fossil fuels. This is a major headwind for the global fossil energy industry, and one that investors should be aware of when they contemplate divestment.

As China seeks to invest away from these fossil fuels, it has also called for a dramatic increase (albeit off of a low base) in non-fossil generation. The 12th Five Year Plan calls for 26% annual growth in wind generation, 30% annual growth in nuclear, and 90% (!) annual growth in solar generation. It is very clear that these non-fossil energy sources will be huge market share gainers in the coming years.

Another interesting tidbit gleaned from the 12th Five Year plan is that China intends to invest heavily in energy efficiency, targeting a 16% annual improvement in its use of energy per unit of GDP. This will have a shrinking effect on the total energy market, exacerbating the market share loss. Once again, we reinforce our hearty skepticism of the prediction made by Chevron's Watson.

Investing Maxim #3: "Skate to Where the Puck is Going to Be"

As we stated before, the Top 200 global fossil fuel companies have a combined market cap of $4.5 trillion. This represents a massive chunk of global equities (~14% of the MSCI Global Index), and we would be hard-pressed to find a major institutional investor that does not already have significant exposure to the fossil energy sector.

Even in the "socially responsible" investing niche, we are stunned to find widespread holdings of fossil-based emitters. For the sake of this paper, we performed an analysis of 51 U.S.-listed managed long-only funds and ETFs that categorize themselves as SRI. Of these, 43 (84%) had substantial holdings in companies whose principal activity is fossil fuel exploration and production. We don't want to belabor the point other than to say that this is pretty good confirmation that, when it comes to fossil fuel investing, everybody is already in the pool.

By contrast, there is paltry equity exposure to alternative energy. In the course of building out benchmarking data for our fund, we were able to identify just 29 U.S.-listed ETFs and long-only funds focused on clean technology, with an aggregate AUM of just $4.6 billion.[20]

Presuming we are right about the cost and market share trends in the overall energy industry, what we have just identified is an inevitable reallocation of $4.5 trillion into a space that only has $4.6 billion of dedicated long-only money invested. Even a 1% reallocation increases the total AUM by an order of magnitude!

To illustrate the potential for returns that this severe underweightedness creates, we reflect on the example of SunEdison. In early 2013, SunEdison began discussing its plans to deploy a YieldCo financing structure – a clever plagiarism of a financing structure popular in the conventional energy industry. The YieldCo structure promised both cheaper capital (i.e., lower cost) and a rapidity of growth (i.e., market share gain) for SunEdison's solar projects.

As the genius of this plan (and the magnitude of capital required to execute it) began to resonate with the equity research community, there was a flurry of upgrades of the stock: Goldman Sachs, Bank of America, Citi, and Credit Suisse all initiated or upgraded within a six month window. From the end of the first quarter to the end of the third quarter, the stock moved from $4.09 to $9.63.

With the newly minted bulge bracket interest in this security, we began to see more interest from larger investment funds. Over the next few months, the solar/specialty finance meetings that we have attended in relative solitude for the past decade became crowded with the household names of the investment world.

In mid-December, SunEdison received a CNBC plug by one of the world's more renowned hedge fund managers. And then in mid-April 2014, SunEdison appeared in the Q1 letter of one of the

[20] Source: Bloomberg Data; Ardsley Partners analysis

hedge fund world's rockstars. By the end of the day, the stock closed at $20.06, nearly 500% higher than at the end of Q1 2013.

SunEdison may be an extreme case, but it has done a tremendous job in reducing its costs – both hard and soft - to the point that many of its projects can go head-to-head with conventional fossil generation on a purely economic basis. The result is a three-year projected growth rate that ought to be a wake-up call to its fossil-based competition whose growth has stagnated. And for the investors that spotted these cost and market share trends early, there were windfall profits to be had.

The overarching point is this: there is relatively little capital currently invested in alternative energy. As the basic economic factors we have discussed in the preceding start to be reflected in the financial results of these companies, the floodgates of capital will open, chasing these obvious returns.

The revelers in the crowded pool of conventional fossil energy will be late to the party.

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Any company-specific information contained herein is shown merely to supplement the thesis of the white paper and then can be no guarantee that products managed by Ardsley have exposure to such companies. Furthermore, as discussed in the risk disclosures above, there can be no guarantee that investments within the Ardsley portfolios will perform in line with company-specific data contained herein.

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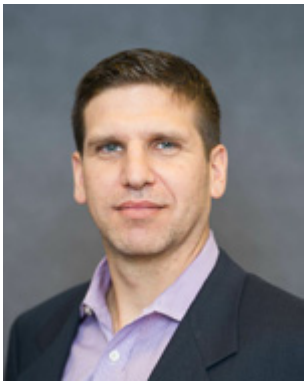

Ben Block joined Ardsley Partners in 2007 and helps lead the firm's Renewable Energy practice. Prior to Ardsley, Ben spent several years with a joint venture of Sempra Energy, where he authored and managed systems that controlled end-to-end utility transactions. In this role, his operation received special commendation from the Georgia Public Utility Commission. Prior to that, Ben had done research in phototrophic energy. Ben received the St. Gallen Wings of Excellence Award for a treatise on renewable energy in emerging markets. He has also been honored with the American Academy of achievement's Golden Scroll Award. Ben received an MBA with honors from New York University and a BA in Physics from the University of California, San Diego.

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