Placing the Chips in An Investor’s Game of Roulette: Global Warming and Its Effect on the Stock Market

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I am a freshman at UK, majoring in FLIE (Foreign Language International Economics) – Japanese, and am a member of the Honors Program. As a brother in the Phi Kappa Tau Fraternity, I am actively involved in the community, volunteering for various groups around Lexington and raising funds for our national philanthropy, Hole in the Wall Camps.

My research into renewable energy investments was an attempt to gain a greater understanding of how global warming will affect the economy. Working with Dr. Atwood throughout the semester in his DSP course, “Energy and Our Global Environment,” has been a tremendous experience. His knowledge about the subject is astounding, and his ability to motivate his students in the active pursuit of knowledge is a rare talent. I cannot thank him enough for his continued support throughout this project.

Faculty Mentor:
David Atwood.
Professor, Department of Chemistry

Clay Bohle was a student in the Discovery Seminar I taught in Fall 2007 entitled “Energy and Our Global Environment.” Toward the end of the course the students were required to use their newly gained knowledge of environmental science to produce a written report and presentation on a topic related to renewable energy. Clay is interested in economics and conceived the idea of evaluating renewable energy stocks in order to suggest the creation of a new mutual fund or the choice of individual stocks for purchase. I worked with Clay on the outline of the report and helped with several drafts of the potential Kaleidoscope submission.

The result of this work was, in my view, a great piece of scholarly research on the future of renewable energy and the companies associated with the new developments. He used the metaphor of roulette as a vehicle for making the choices. I am quite well read in the environmental literature and I have not seen such a detailed, interesting treatment published anywhere. Clay has created something interesting, timely and useful in this Kaleidoscope submission. I expect that it will be of great interest and utility to the readers of Kaleidoscope. Furthermore, I am going to use his article in my future teaching of DSP courses and environmental science.

Placing the Chips in An Investor’s Game of Roulette

Global Warming and Its Effect on the Stock Market

Abstract
The Kyoto Protocol, an international agreement aimed at cutting greenhouse gas emissions, has radically changed the global market for green technology. The demand for clean energy has increased, causing an influx of new companies producing renewable energy products and creating cleaner processes for fossil fuel consumption. The question is: how can we, as investors, take advantage of this growing market? Through research into the different sectors of the green energy market, this paper breaks down each type of renewable energy, providing an evaluation of the various investment options. Comparing these investments with the different betting options in roulette, the paper moves from low risk, low return investments to more potentially lucrative options. Ultimately, the readers are offered the advice of analysts and speculators on individual companies in which to invest, including the stock quote and quarterly earnings of each company. This will provide the opportunity to not only support the growth of sustainable, green energy, but to profit from the choices made.

Introduction
Roulette is a game of chance in which the player bets on the slot of a rotating wheel in which he thinks the ball will stop. With 38 choices on the American wheel, it is difficult to pick the correct number. There are several ways to win, however, each with a different chance of success and with varying payouts. One can make a safe bet, placing chips on either red, black, even, or odd. The odds of winning are 1.111 to 1, with a payout that is 1 to 1. Or if one is feeling lucky, he or she can put all the chips on a single number, 37 to 1 odds, but with a 35 to 1 payout. These are the two ends of the spectrum with many options in between, ranging from 2, 6, 11, or 17 to 1 payouts, and there are many betting combinations to increase the chance of success.
The stock market can be a similar game, especially when investing in immature markets. With new companies going public every month in these growing markets, it is nearly impossible to guess which ones will be successful. The Kyoto Protocol, an international effort to reduce global warming, has created a popular market for green technology. From renewable energy to cleaner fossil fuel processes, there are plenty of options for investment. Trying to choose which company on which to place your money is as risky as betting on a single number in roulette, but what if it were possible to narrow the choices?

By evaluating the different investment options in the green technology market, this study attempts to do just that. Starting from the standpoint of choosing either red or black, the strengths and weaknesses of both renewable energy and cleaner processes are discussed, narrowing the market to a single sector — renewable energy. Each renewable energy option is then analyzed: nuclear power, hydropower, geothermal energy, wind power, and solar energy. Again, the advantages and disadvantages of each are discussed, narrowing the choices to a single renewable energy option. Using the advice of several analysts and speculators, individual companies within this renewable energy field are examined, essentially giving the reader an educated bet on which single number to place his or her chips, with the possibility of earning a 35 to 1 payout.

Should the Game be Played?

With the recent awarding of the Nobel Peace Prize to Al Gore and the Intergovernmental Panel on Climate Control (IPCC) for their work on human-induced global warming, there is no doubt of the forefront position that global warming has taken as a global issue. With the exception of the United States, the developed world has committed itself to cutting carbon emissions by ratifying the Kyoto Protocol of 1997. Reducing carbon emissions, whether through alternative energy or cleaner processes, will fundamentally change the global stock market. It is unknown which sectors of the market will come out on top, but by analyzing the investment options in green energy, it may be possible to narrow the choices and reduce the risks in placing a bet. Playing the stock market will be a game of roulette, and as an investor, the question is: Where should the chips be placed in order to cash in on the changing market?

The Kyoto Protocol of 1997 set a goal of reducing carbon emissions to 5% below the 1990 levels, to reach an atmospheric CO$_2$ concentration of approximately 320 parts per million, by 2012. This is only the first step in reducing carbon emissions to double pre-industrial levels, which would require a reduction by all nations to 60% of the 1990 levels. (Bailey et al., 2002, p. 178) When the Kyoto Protocol expires in 2012, it is possible that a new agreement will attempt to make more progress toward this end goal. Cutting carbon emissions by this amount will require a shift to using green renewable energy technologies, such as solar, wind, or hydropower, or making the carbon-based energy sources, oil, natural gas, and coal, cleaner.

At present, 133 nations have signed the Kyoto Protocol. (Gore, 2006, p. 282) With Australia signing earlier this year, the only developed country that has not ratified the document is the United States. With a presidential election taking place this year, however, it is likely that the new administration will support the Kyoto Protocol, initiating substantial carbon emission cuts in the U.S. In 2000, the United States accounted for 25% of the Earth’s energy use, despite having only 5% of the world’s population. (Bailey et al., 2002, p. 10) If the Protocol were ratified by the U.S., the effect on the market would be exponential.

Australia has the highest per capita greenhouse emissions of any industrialized country, with 90% of its electricity produced by burning coal. It also has, however, the world’s greatest geothermal resources, 28% of the world’s uranium, and a more than adequate supply of solar and wind resources. (Flannery, 2005, p. 226) Now that Australia has ratified the Kyoto Protocol, it should have a relatively easy job of cutting carbon emissions by taking advantage of its sustainable energy resources.
The potential entrance of the U.S. into an already attractive pool of green technology consumers will cause a shift of the demand curve to the right, raising the value of each share invested in green technology. There is a visible stack of chips behind the wheel. If one bets correctly, there is a guaranteed profit to be made in green technology investments. It would be a safe bet to blanket the table, putting money in every possible technology through mutual funds; at least one of the chips is sure to turn a profit. However, this safe, relatively expensive bet would dramatically reduce the profits that could be realized.

Red or Black?

In order to obtain a more profitable return, one must look at the individual options. As previously mentioned, cutting carbon emissions to Kyoto Protocol levels will require a shift to using green technologies that either use renewable energies or make fossil fuels cleaner.

Shell and Krantz (2007) discussed the possible investments in green technologies. In the section of their article on alternative energy, the authors provided the opinion of Robert Wilder, CEO of WilderShares, stating that alternative energy plays are not the best route to profits because the technologies are too immature. Instead, Wilder prefers the technologies that provide cleaner carbon-based energy. Fuel Tech, for example, creates devices that reduce carbon emissions from factory smoke stacks. According to Wilder, one should place one’s chips on black.

The most recent predictions, however, indicate that the time remaining in the age of petroleum will be counted in decades. It is estimated that U.S. oil reserves will be exhausted in 29 years (excluding the immense Bakken field, which cannot be effectively recovered with current technology), assuming the level of imported oil remains constant. (Bailey et al., 2002, p. 17) With competition from rapidly growing China and India, that level may drop in the coming years, exhausting U.S. reserves even faster.

Simmons (2005) sees an energy crisis in the immediate future. He studied energy for over 30 years on-site in the Middle East, analyzing the amount of easily obtained oil and natural gas remaining. He has concluded that “proven reserves” are worthless data. He believes that the world’s oil peak is much closer than the Saudis are telling us.

There is, of course, the previously mentioned Bakken field lying underground in the Northern U.S. and Canada. Although the estimates of the amount of oil constantly change, the most recent indication is that there are between 271 and 503 billion barrels, a number that dwarfs the remaining Saudi fields. (Langston, 2008)

The problem, however, is that not all of this oil can be recovered with present technology; only an estimated 3 to 50 percent, which brings up another investment option. (Langston, 2008) An investment in companies such as Gardner Denver, with new recovery technologies, for this and other reserves might seem profitable, given that current drilling of the Bakken formation has seen low direct drilling costs, a factor that will reduce the cost of oil per barrel and thus raise demand. There are, however, two drawbacks. While these new reserves of oil may seem heartening based on our current carbon-based economy and concerns about dwindling supplies, focusing on its recovery will only delay the switch to renewable energy and thus worsen the carbon emission problem. In addition, like all other oil reserves, they will eventually run out, and given currently increasing consumption rates, perhaps sooner than one might think.

Once the petroleum reserves are used up, they are gone for good. This is a problem not only for energy production but also for the multitude of commodities that rely on petroleum as a feedstock, such as plastics and chemicals. Oil originates from buried plankton and plant life deposited over many millions of years in the oceans, which doesn’t decompose in the oxygen-free deep waters. (Flannery, 2005, p. 75) It takes millions of additional years for these biological deposits to be converted into oil through pressurization, high temperatures, and bacterial degradation. One hundred tons of ancient plant life are required to create one gallon of gasoline, and in 1995, the world was using an average of 24 billion barrels of oil per year. (Flannery, 2005, p. 76) This rate would render the 503 billion barrel Bakken field empty in a matter of 20 years. If the predictions are correct, this means that some of the black numbers will be removed from the wheel; with no oil, technologies that clean it or recover it will be worthless. It does not make sense to bet on an option that will not be there when the ball settles onto its final slot.

Of course, there are other fossil fuels besides oil. Natural gas and coal are predicted to last for at least a few more centuries. There are reserves of stranded natural gas that could produce 250 billion barrels of synthetic diesel fuel, but there is presently no economical way of transporting it. (Cook, 2004) Synthetic fuel, unlike crude oil, doesn’t emit sulfur when burned, making it more valuable to those trying to cut greenhouse gas emissions. If the price of crude oil is $37 per barrel, the reduced environmental problems mean that synthetics could be sold for as much as $57. (Cook, 2004)

For any economic market, the demand curve is quite inelastic in the short-run. (Mankiw, 2007, p. 91) Consumers do not respond to price fluctuations because there are few or no alternatives. Take, for example, the
market for gasoline. People may complain as gas prices continue to rise, but they will keep filling up their tanks because they rely on gasoline for their livelihoods. In most cities, people must commute to work because they cannot afford the real-estate prices inside the city. They cannot walk to work and, in much of the U.S., public transportation is less than adequate. In the long-run, however, as newer technologies are produced and alternatives are created, the demand curve becomes more elastic. (Mankiw, 2007, p. 91) As gas prices continue to rise, as they are projected to due to falling reserves, consumers will switch to more efficient hybrid cars now becoming available in order to avoid the high costs of gasoline.

If all consumers switch to hybrid cars, gasoline consumption would dramatically decrease and the demand curve for gasoline will shift to the left, driving down prices. As a result, synthetic fuels will either suffer losses because of their high prices if they enter the market before petroleum runs dry, or synthetics will enter a market with little demand, after consumers have already switched to newer technologies.

The same analogy can be used for coal and large factories. As prices for petroleum shoot up in response to dwindling reserves, factories will switch to newer technologies, namely renewable energies, which will become cheaper. During the energy crisis of 1973, gas prices almost doubled from 38.5 cents a gallon to 55.1 cents in one year, and New York Stock Exchange shares in gasoline lost $97 billion in value in six weeks. (1973 Oil Crisis, 2007) The United States government poured funding into nuclear research to break the dependency on foreign oil. However, no new nuclear power plants were built after the Three-Mile Island incident in 1979.

Though natural gas and coal may last for centuries more, economic forces will render them obsolete as consumers switch to green energies in order to dodge rising petroleum prices. Therefore, if one bets on black, technologies that clean fossil fuels or recover existing reserves, he or she will be putting chips on numbers that will be removed from the wheel, effectively throwing that money away. Based on this evaluation, the bet should be placed on red, that is, on renewable energies.

Narrowing the Board

There are several renewable resources available for investments: nuclear, geothermal, wind, solar, and hydropower are the most common. Renewable energy currently accounts for 14% of global energy consumption. (Bailey et al., 2002, p. 74) A mutual fund covering them all would be a guaranteed profit. Larger returns are possible, though, because some renewable energies are more potentially lucrative than others.

Nuclear power already provides 18% of the world’s electricity, with no carbon dioxide emissions. However, waste disposal presents a problem. If the use of nuclear energy continues to rise, waste management will become a more serious issue, and one that will increase the costs of this energy source. Already, the Chernobyl and Three Mile Island accidents have been deterrents in the planning for nuclear power. (Duetsch and Moniz, 2006) Other problems may arise from earthquakes because many of the major disposal sites are located on fault lines.

Nuclear waste can be recycled in what is known as a closed-fuel cycle, in which the plutonium is chemically extracted and turned into fuel for use at another plant. Recycling fuel, however, lowers the plant’s efficiency, because it uses a portion of the energy produced to recycle the waste. This process could potentially raise the price of nuclear energy above some of the other renewable energy options. (Duetsch and Moniz, 2006)

Furthermore, if all gas- and coal-powered plants were displaced by nuclear plants, a process that could be completed by 2050, global carbon emissions would be reduced by only approximately 1.5 billion tons per year. Considering that humans put 13 billion tons of carbon dioxide into the atmosphere each year, this reduction would not be enough to meet the end goals of Kyoto Protocol type agreements. (Duetsch and Moniz, 2006)

Hydropower is another possible investment option. It currently produces 20% of the world’s electricity created by renewable energy. (Bailey et al., 2002, p. 92) Hydropower has its drawbacks, however. Water backing up behind dams floods the shoreline, swamping human residences, archeological sites, and ecosystems, and it permanently alters the character of the river. Dams also hold back silt, which can have harmful effects downstream. The most well-known example is Egypt’s Aswan dam, which stopped the annual flooding of the Nile, diminishing nutrient inputs for the crops of the Nile delta. (Bailey et al., 2002, p. 92) Additionally, the more widespread use of hydropower is limited by geographical considerations.

Geothermal energy is another option, but at present, it only provides 0.3% of the world’s electricity. Geothermal steam is only available in the parts of the Earth’s crust where the concentrated upwelling of heat from the Earth’s mantle occurs. (Bailey et al., 2002, p. 96) Now that Australia has ratified the Kyoto Protocol, it could tap into its rich geothermal province, raising the percentage of global usage significantly. The rest of the world, however, lacks such rich provinces, making geothermal technology a less popular option for governments to promote. Instead, it is more likely that Australia will use solar or wind power to produce its electricity, because it will have already been more
heavily developed by the time Australia begins cutting its carbon emissions.

That leaves wind and solar power as the two options for producing enough electricity to satisfy the world’s growing demand, and the final two choices for investment. Both are solid options. Wind electricity is now the lowest cost alternative to electricity from fossil fuels and nuclear plants. (Bailey et al., 2002, p. 93) Between 1990 and 1999, the rate of annual growth of wind electricity averaged 24 percent and is projected to continue increasing. (Bailey et al., 2002, p. 93) The problem with wind power, however, is that it lacks diversity. Wind power can displace coal-powered plants, but that is the extent of its use: creating electricity.

Solar power can potentially be used for a variety of energy sources, from producing electricity to powering a car, and there is an unlimited supply. Only 70% of the Sun’s energy is captured by the Earth. Currently, humans only use 0.02% and plants use 0.34%. The rest of the energy is absorbed by the atmosphere (24%), the land (14%), and the oceans (32%). The other 30% is reflected back into space by the Earth’s albedo. (Bailey et al., 2002, p. 7) Harnessing even a fraction of this incoming energy could easily make all coal and nuclear power plants obsolete.

The annual energy deposited by sunlight on the continental United States is nearly 600 times the total annual U.S. energy consumption in 1999. Enough sunlight falls yearly on each square meter to equal the energy content of 190 kilograms of high-grade bituminous coal. (Bailey et al., 2002, p. 74) Using flat-plate solar collectors converting sunlight to electricity at 10% efficiency, it would only take an area of 10,000 square miles in the Nevada desert to supply the total energy needs of the United States. (Bailey et al., 2002, p. 79)

Currently, solar panels are operating at an average conversion efficiency of 16 percent, but this number is expected to rise. In February of 2007, SunPower redesigned their solar panels to reduce the amount of sunlight being reflected away from the silicon, increasing efficiency to an industry-high 22 percent. (Davidson, 2007) For comparative purposes, 95% of the global plant biomass converts sunlight into carbohydrates at an efficiency rate of about 14 percent. (Bailey et al., 2002, p. 86) In addition, a new, cooler process for solar-grade silicon has been developed, which reduces energy consumption by 80%, further increasing the rate of efficiency. (Bailey et al., 2002, p. 81)

Research is also being conducted in the field of nanotechnology. In 2005, a form of solar paint was developed. Plastic solar cells, which capture the Sun’s infrared energy as well as visible light, can be sprayed onto other materials and used as a portable source of electricity. (Lovgren, 2005) In theory, a hydrogen-powered car with the new solar paint could convert enough energy to continually recharge its battery. Or, the paint could be applied to clothing in order to absorb enough energy to continually recharge a cell phone carried in one’s pocket. The new solar cells could raise conversion efficiency to 30 percent. (Lovgren, 2005)

Many governments around the world also offer subsidies to citizens using solar energy. In the United States, residents of New York can receive a $4.00 per watt incentive, covering half the cost of solar energy, and a 25% tax credit, capped at $5,000. (USA, 2007) In addition, solar electric systems installed before January 1, 2011, are exempt from property tax. Any unconsumed energy that a solar power system creates is considered a cash credit on one’s power bill. New Jersey and California residents receive similar incentives. (USA, 2007)

All things considered, solar energy seems to be the most attractive option for investment. This narrows the roulette board significantly and increases the possible returns on a successful bet. After eliminating all other forms of renewable energy, one can confidently place the chips on one of the columns, 2 to 1 payout.

**Feelin’ Lucky**

Tripling one’s money would be a job well done for most investors, but suppose one wants the largest return possible. For the 35 to 1 payout, all chips must be put on one number, on one company. Picking out a single company from an industry can be a difficult process, but there are certain aspects of a company that can be used to narrow the choices.

As the evidence shows, solar energy has the most potential for becoming the premier form of global energy production. This is no secret, and as such, the market for solar energy is overcrowded. By November, the year of 2007 had seen eight new companies go public, four of them in the Chinese market. In an already overpopulated industry, this has put downward pressure on stock values. (Sylla and Axel, 2007)

This trend can be deceiving at first, resembling a failing market. Almost all of the companies are seeing their stock values depreciate. The economic forces of supply and demand are at work here. (Sylla and Axel, 2007) Investors have too many solar companies to choose from, thinly spreading the capital over the market. Companies see earnings fall short of projections as investors put their money into new companies that go public.

The fierce competition, however, will end up having a positive effect on the market. Companies will quickly develop new technologies to differentiate themselves from one another. (Sylla and Axel, 2007) The market will see the new start-up companies shift into specialized
suppliers, offering more efficient and diverse products. As a result, the solar energy industry will continue to grow and stock values will rise.

Analysts predict that by the end of 2008, investors will begin to see which companies will make it through the saturation of the solar market, and which companies will crumble beneath the competition. Most financial advisors suggest waiting for one or two quarterly earnings reports before investing in a particular company. This allows one to see the upper management skills and productivity of a company before making a decision. (Sylla and Axel, 2007)

With new markets, and solar energy is a relatively new market, it is important to look for diversity in a company. (Sylla and Axel, 2007) Different sectors of the solar industry will rise and fall as new technology is produced. A company needs to have flexibility in this regard in order to survive. Many analysts refer to this as the ability of a company to “take a hit.” The company should have a wide variety of products within the solar market in order to cope with the shift in demand that will occur as new technologies are introduced. If one sector of the market fails, the company will be able to survive through the rest of its production options.

Stock value is another important characteristic to look at when choosing in which company to invest. The obvious goal is to buy low and sell high. Especially with new companies, the stock price can be enticingly low. It pays to be patient on the start-up companies, however, because the solar market is overcrowded. Many times, new companies cannot compete with the large competition and exit the market as quickly as they enter. Investing in new companies to take advantage of the low stock prices is a dangerous bet, one that most analysts would not recommend.

Here is a look at some of the individual companies in the solar energy market. The prices quoted are for Nov. 14, 2007 (Renewable, 2007):

1) SunPower Corp. was mentioned earlier in the article for their redesign of the solar panel. SunPower Corp. is one of the most widely suggested investment options in the market. As of Nov. 14, 2007, the last trade went for $115.90, up $7.48 for the day. Six months beforehand, the stock was worth less than $60.00, and in January of 2007, it had a value of about $35.00 per share. The one year target estimate is $130.00. The P/E ratio, however, is extremely high, at 85.35. This could be due to high projected earnings for the company, or could be a speculative bubble based on the hype surrounding the company. Historically, bubbles have been followed by crashes, so it may be wise to take a wait and see approach with this company.

2) Solon ended the day with a value of $80.60, up $2.88 for the day. In January of 2007, the stock was worth around $20.00 per share. In October, the company had taken losses, however, so their P/E ratio is undefined or N/A.

3) Solar Integrated Technologies ended at $88.50, down $2.50 for the day. The stock began the year with a value of $22.00. Like Solon, the company had suffered losses in November, making their P/E ratio undefined.

4) Suntech Power Holdings, another highly suggested investment option, ended with a value of $61.69, up $1.99 for the day. January saw a stock value of around $28.00. The one year target estimate is $54.89, which they have exceeded. The P/E ratio is 77.70, relatively low compared to SunPower Corp., but still a high number.

5) Yingli Green Energy Holding Company Unlimited is one of the leading Chinese solar companies. It's still a relatively new company, having gone public in June of 2006. It ended the day with a value of $30.73, up $1.60. In June of 2007, the stock was worth less than $10.00 per share. In October, it suffered losses, displaying an undefined P/E ratio.

It is important to remember the effects of the overcrowded market when looking at the losses many of the companies have suffered.

Shrewd speculators Kevin Sylla and Eric Axel offer their suggestions for solar stock investments on InvestorIdeas.com in an audio file entitled, “Solar IPO’s and the Chinese Solar Market.” The two speculators believe that the solar energy market is the correct investment option. When asked which stocks they would suggest to potential investors looking to break into the solar market, Eric Axel mentions SunPower Corp. and Suntech Power Holdings. He says that many analysts are pushing these two companies as the dominant players in the solar sector. He is not currently suggesting these two companies to his own clients due to the high P/E ratios. Kevin Sylla, though he does not usually recommend single stock investments, suggests Yingli Green Energy, believing that it has the diversity to be successful in the solar market. He mentions that the undefined P/E is just a result of the overcrowded market and should not keep people from investing in the company.

All Bets on the Table

Through the process of elimination, and based on the advice of speculators and analysts, the board has been narrowed to the sector of the market that has the most potential for profit: solar energy. Due to the Kyoto Protocol, much of the developed world is cutting carbon
emissions and looking for a source of green energy. With its variety of energy uses, technological advances, and government subsidies, solar power appears to have the most potential for becoming the premier source of global energy.

According to the basic principle of “buy low, sell high,” the time to invest in this new market is now. An investment in solar energy should see a constant increase in value, with staggering returns possible in twenty to thirty years. Investing in a mutual fund of solar energy companies could be a safe but lucrative bet. Like betting on the columns in roulette, 2.167 to 1 odds, the chances of making a solid profit are good. If one is a risk-taker, however, wanting to invest in a single company, the best option would be Yingli Green Energy Holding Company Unlimited. They have the diversity to “take a hit” in a new market that will change with the technological advances. At present, the value of the stock is low, at $30.73, so the returns could be enormous. It fits well with the roulette metaphor; betting on a single number with a 35 to 1 payout.

The wheel has begun spinning; it’s time to place one’s bets.

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Works Cited


