AN INTRODUCTION TO GREEN COMMODITY INVESTMENT

AIA RESEARCH REPORT

Original: June 28, 2009

ALTERNATIVE INVESTMENT ANALYTICS LLC
29 SOUTH PLEASANT STREET
AMHERST MA 01002

Authors:

Melissa Donohue
mdonohue@alternativeanalytics.com

George Martin
gmartin@alternativeanalytics.com

Richard Spurgin, Ph.D.
rspurgin@alternativeanalytics.com

Satyabrota Das
sdas@alternativeanalytics.com

Alternative Investment Analytics LLC
29 South Pleasant Street
Amherst MA 01002

www.alternativeanalytics.com

P: 413.253.4601
F: 413.253.4613

An Introduction to Green Commodity Investment

TABLE OF CONTENTS

1. Introduction

Intensified focus on the health of the planet has driven technological research and global political policy toward the creation and use of clean, green fuels and technology. Given the increased policy focus in the U.S. and other parts of the globe, those industries that are working to create renewable energy and reduce carbon emissions have the potential to continue to expand while other areas of the global economy may continue to falter. Investor interest has grown, driven in part by a desire for more ethical, "earth-friendly" energy-related investments, but also by the realization that few energy-related sectors have the same potential for near- and long-term growth.

Additionally, public and private institutions seeking to navigate the increasing importance of green alternative investments are in need of a range of tools, including financial assets that can act as a benchmark, a hedge, a speculative asset, and as a tool to promote economic transformation toward a greener economy. Green investment is becoming an increasingly important sector for investors, both as a source of return and diversification, but also as the first step into an emerging market that may eventually dominate energy markets.

This paper will define green commodity investments and sub-sectors. It will also examine current sources of return to green commodity investments. The paper will also introduce the Bache Green Commodity Index[1] (BCGI[SM]), and analyze its performance compared to other green commodity indices, broad commodity indices, and the major asset classes. It will also examine the BCGI's contribution in different portfolio contexts.

2. Sources of Return to Green Commodity Investments

Production and consumption of green commodities are expected to increase steadily over time. Part of this dynamic involves new government policies that dedicate public spending to clean energy initiatives. More stringent environmental standards for individuals and organizations will also spur demand. Greater demand for green commodities may boost prices, resulting in attractive returns to investors in these markets.

Policy initiatives in 2009 include a green "New Deal" with hundreds of billions of dollars of public spending globally expected to be devoted to green projects. By some accounts, this spending could total $430 billion, or 15% of the $2.8 trillion stimulus spending expected globally[3]. Additionally, this government spending could spur complementary private sector investment in the green economy.

The focus on alternative energy is also increasing. Energy security is a pressing issue for importers of oil and gas. Governments are concerned about over-reliance on any single energy supplier, or relying on politically unstable regions. The volatile price of oil in recent years has intensified those worries. Due to the finite nature of fossil fuel supplies, it is a challenge to find new sources of supply as the most easily reached sources are now depleted.

At the same time, emissions from fossil fuels are having an increasingly detrimental impact on the globe. Global emissions of the main greenhouse gas carbon dioxide will jump more than 39% from 2006 levels by 2030 without new policies and binding pacts to cut global warming pollution, according to the Energy Information Administration.

---

[1] See "Guide to the Bache Commodity Green Index[SM], the Bache Biofuel Index[SM], the Bache Clean Air Index[SM] for further information on the BCGI[SM] methodology.

[3] See "The green new deal: A massive injection of clean energy cash," FT.com, March 13, 2009.

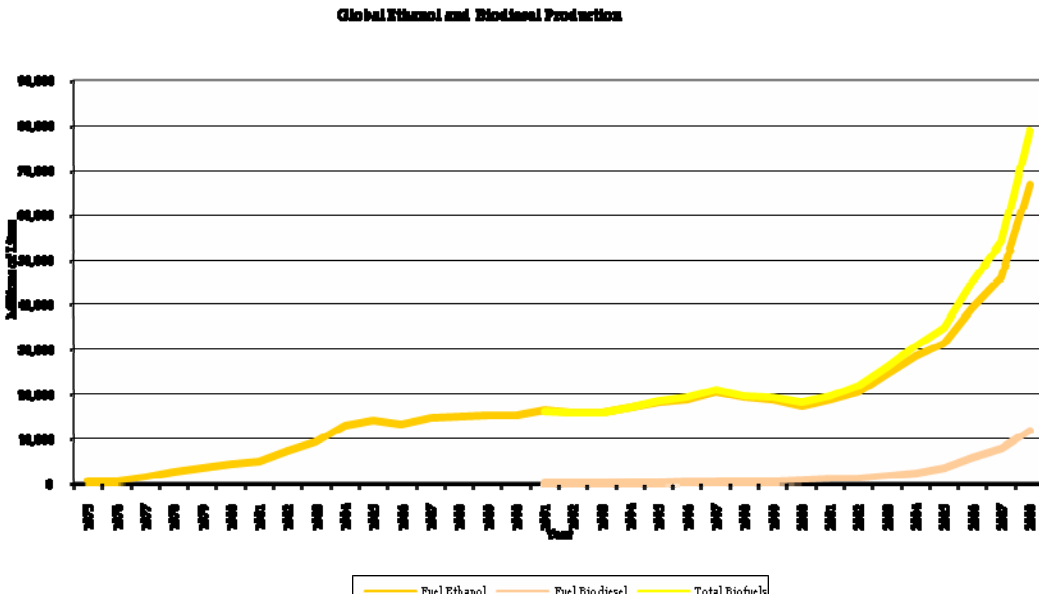
The major green commodity markets can be segregated into four main sectors: Biodiesel, ethanol, carbon credits, and pollution control. A diversified perspective includes both alternative fuels, and mechanisms for the control and remediation of the impact of fossil fuel usage. Biodiesel and ethanol are both alternative fuels. Carbon credits ensure that greenhouse gas emissions are allocated efficiently, and pollution control metals can cause a chemical reaction to neutralize different types of harmful gases including hydrocarbons, carbon monoxide, and nitrous oxide.

2.1 Biodiesel and Ethanol Feedstock

The largest quantities of biofuel production are either corn-based or sugar-based ethanol. Biofuel production has also expanded to include other forms of biomass to become a significant source of energy in the transport area. Biofuels have the advantage of being produced from renewable resources like plant biomass that are locally available, and are also produced using known technology. Biofuel use generally reduces the emissions footprint relative to fossil fuels of its primary users in the transportation sector.

As transport-related energy has been one of the largest sources of fossil fuel consumption, this critical need has led to the increasing development of alternative, biofuel-based renewable fuels. In recent years there has been a sustained growth in the production of biofuels to substitute for oil based sources of energy. Figure 1 below shows the exponential growth in biofuels.

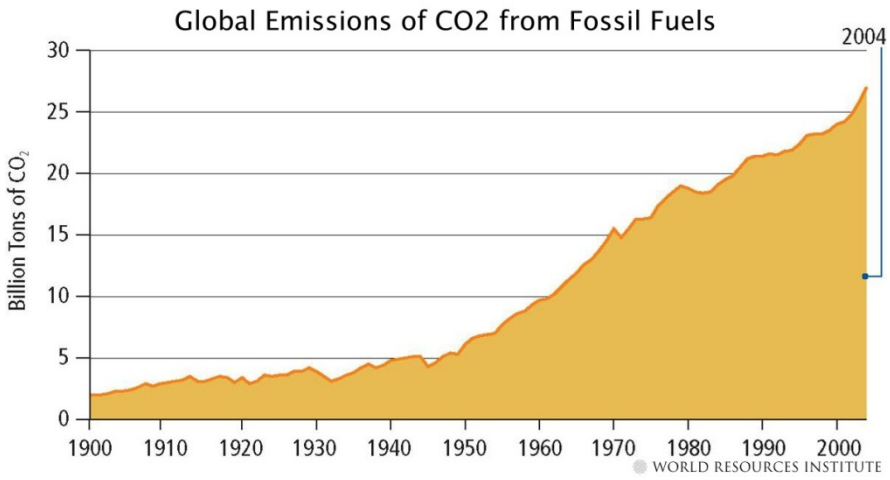
Figure 1. Global Biofuel Production, 1975 to 2008[7]



2.2 Carbon

The limitations and dangers of extensive usage of energy derived from fossil fuels have been widely researched. The use of fossil fuels can lead to carbon-based and carbon-related emissions in key areas of electricity generation, transportation, and industry. Global emissions of CO_2 from fossil fuels have risen dramatically in recent years, as indicated by Figure 2.

Figure 2. Global CO2 Emissions, 1900 to 2004



Carbon credits are traded in most of the developed world, with the most active markets in the EU, US, Canada, and Japan. However, the EU is the only system with a hard cap on carbon emissions. Outside of the EU, purchasing credits to offset carbon emissions is largely voluntary. In addition to carbon markets, there are markets for the right to emit other pollutants such as nitrous oxide and sulfur dioxide. None of these markets have sufficient liquidity for investment at this time.[9]

The value of the carbon market doubled in 2008 to $126 billion, according to the World Bank. The total volume of trade rose 61% to 4.8 billion tonnes of carbon dioxide equivalent (CO_2), compared to 3.0 billion tonnes in 2007[10].

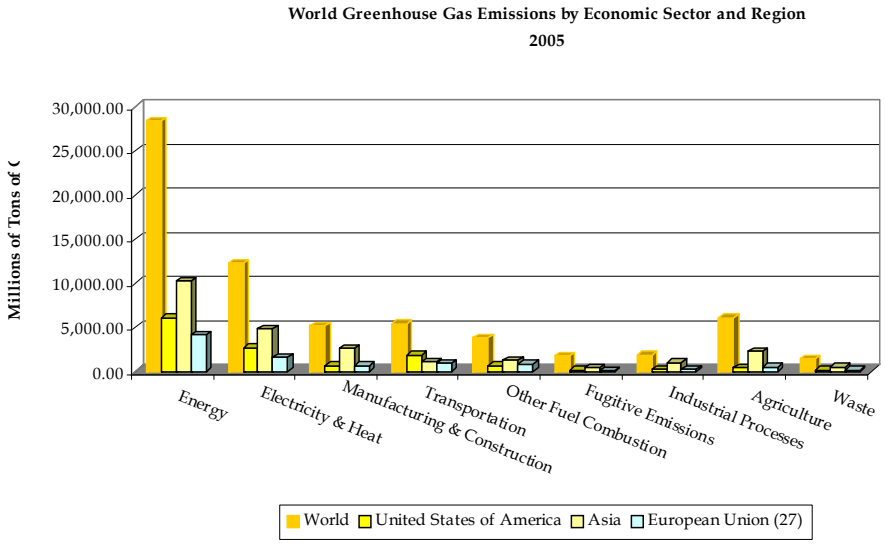
Over half the supply of platinum and palladium, and over 80% of the world production of rhodium, go into catalytic convertors, which convert up to 90% of harmful gases from auto exhaust (hydrocarbons, carbon monoxide and nitrogen oxide) into less harmful substances (nitrogen, carbon dioxide and water vapor).

2.3 Pollution Control

Figure 3 below indicates that the major source of greenhouse gas (GHG) emissions globally is energy production, including electricity and heat, transportation, manufacturing, and construction. Appendix 2 offers a more detailed breakdown of sources of GHG emissions, and details the types of gases emitted including CO_2, methane, and N_2O.

[9] The EU carbon scheme allows Carbon credits to be exchanged for pollution credits, so carbon and pollution markets are integrated under the EU approach.
[10] See http://www.pointcarbon.com.

Figure 3



3. The Bache Commodity Green Index

The BCGI[SM] provides a benchmark for green commodity investments as well as a diversified investment vehicle. It offers a multi-faceted approach to holding commodities and materials needed in the production of renewable energy and the reduction of carbon emissions.

The BCGI[SM] is comprised of eleven commodities that are traded on major exchanges and through over-the-counter markets located in the US, Canada, UK, France, and Malaysia. The BCGI[SM] is primarily comprised of commodities traded via futures contracts, but includes commodities that are traded over-the-counter directly or through forward contracts. The primary objective of the BCGI[SM] is to provide a multi-faceted approach to holding commodities needed in the production of renewable energy and the reduction of carbon emission.

Figure 4

Bache Commodity Green Index[SM] Components: June 2009				
Commodity Market	*Exchange*	*Sector*	*Sub-Sector*	*Allocation (%)*
Corn	CBOT	Agriculture	Ethanol Feedstock	27.0
Sugar	NYBOT	Agriculture	Ethanol Feedstock	12.0
Soybeans	CBOT	Agriculture	Biodiesel Feedstock	12.0
Cotton	NYBOT	Agriculture	Biodiesel Feedstock	3.0
Palm Oil	MCX	Agriculture	Biodiesel Feedstock	1.5
Rapeseed	EOP	Agriculture	Biodiesel Feedstock	1.5
Canola Oil	WCE	Agriculture	Biodiesel Feedstock	3.0
Carbon Futures	ECX	Emissions	Carbon	14.0
Carbon Spot	BlueNext	Emissions	Carbon	14.0
Platinum	COMEX	Metals	Pollution Control	8.0
Palladium	COMEX	Metals	Pollution Control	3.0
Rhodium	Spot	Metals	Pollution Control	1.0
Total				100.0

There are additional objectives of the BCGI[SM] methodology, given that the BCGI[SM] may be held as an investment asset. The first of these is to provide long-term and broad-based exposure to individual commodities within the biofuel and clean environment sectors in a manner consistent with their overall importance to that sector as well as their market liquidity. The second objective is to exploit predictability, broadly defined, in the prices of the underlying commodities, in order to enhance the returns of the BCGI[SM] and to reduce its risk of a large capital loss.

4. The BCGI[SM] in an Investment Portfolio

In this section, the investment properties of the BCGI will be examined relative to other green commodity indices, broad commodity indices, and the major asset classes.

4.1 Green Commodity Portfolios

There are several approaches to investing in the green economy.[11] The dominant green investment strategy involves buying equities. A number of indices track different sectors of the green equity markets. In the commodity area, biofuel indices provide exposure to agricultural products used to create fuel in an environmentally friendly way. These indices include commodities like corn and sugar, which are used in the production of ethanol. A third source of green investments is through carbon credits. Investment choices in the carbon economy include trading carbon credits, investment in carbon reduction projects, and investment in corporations that are developing carbon reduction and sequestration technology.

With its inclusion of emissions-related commodities, the BCGI[SM] is broader in focus than the biofuel-oriented indices, but differs from the equity-oriented "clean energy" indices by including direct exposure to emissions-related commodities or claims (such as carbon emissions credits). In Figure 5

[11] For a more extensive review of the green index investment universe, see the "Green Commodity Index Comparison" (forthcoming).

below, the BCGI[SM] is compared to biofuel and clean energy equity indices. The S&P Global Clean Energy and Wilderhill Clean Energy indices have been combined into an equally-weighted composite index ("Clean Energy Composite"). For a description of each green index, see Appendix 1.

Figure 5

Performance of Green Indices: Jan 2007 to May 2009

		Biofuel Indices				
	Bache Commodity Green Index	Bunge Four Blend Biofuel Price Index	MLCX - Biofuels TR Index	S&P GSCI Biofuel TR Index	UBS Diapason Global Biofuel TR Index	Avg of S&P Global Clean Energy and Wilderhill Clean Energy Index
Annualized Return	5.8%	1.8%	8.1%	-1.8%	-2.0%	-17.4%
Annualized Std. Dev.	27.4%	33.9%	29.2%	28.6%	27.1%	44.2%
Sharpe Ratio*	0.21	0.12	0.29	-0.04	-0.07	-0.27
Maximum Drawdown	-48.7%	-60.2%	-44.0%	-44.5%	-44.1%	-75.8%
Max Monthly Return	16.0%	17.3%	16.4%	15.5%	14.0%	18.3%
Min Monthly Return	-15.8%	-28.0%	-15.5%	-17.7%	-17.3%	-36.0%
Correlation with Bache Commodity Green Index	1.00	0.78	0.89	0.88	0.89	0.60

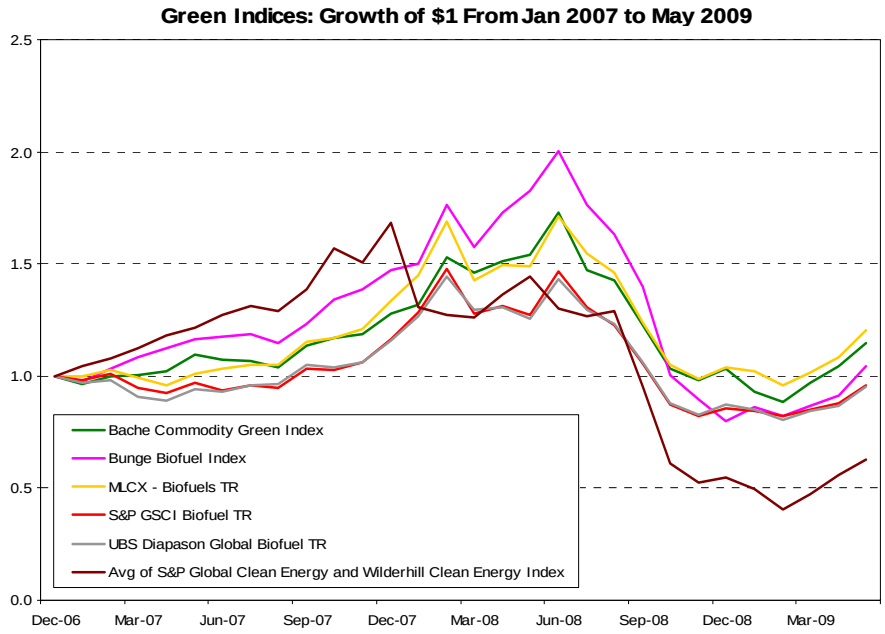
* Using 3-month T-Bill rate as risk-free rate

Since January 2007, average annualized returns for BCGI[SM] and Biofuel Indices have been roughly -1.8% to 8.1%.

In the period of January 2007 to March 2009, the performance of the green indices included in the table above has been volatile, with equity-oriented indices experiencing the most risk. With an annualized standard deviation of 27.4%, the BCGI[SM] has had among the lowest volatility of all of these green indices. In terms of other measures of risk, such as maximum drawdown, the BCGI[SM] has had a maximum drawdown based on monthly observations of -48.7%, which is comparable to other Biofuel indices. The Clean Energy composite had a drawdown of -75.8%, which was significantly greater than any of the other Green indices.

Figure 6 provides a chart of the cumulative performance of the sample green commodity indices over this time period. In this relatively brief period there was a substantial run-up and then collapse in prices across green commodities and equities. The Clean Energy composite experienced a boom earlier than the indices offering direct biofuel exposure, but also suffered an earlier and more substantial decline.

Figure 6



The BCGI[SM] is more correlated with the Biofuel indices (.78 to .89) than with the equity-based Clean Energy composite (.56). Three of the biofuel indices (MCLX, S&P GSCI and UBS Diapason) are highly correlated with correlations in the .97 to .99. The Biofuel indices have had relatively low correlation with the Clean Energy composite, but the BCGI[SM] has had among the highest correlation at (.60), which may reflect the mutual exposure of Clean Energy composite and the BCGI[SM] to clean air related assets.

Figure 7

Correlation among Green Indices (using monthly data from Jan 2007 to May 2009)

	Bache Commodity Green Index	Bunge Four Blend Biofuel Price Index	MLCX - Biofuels TR Index	S&P GSCI Biofuel TR Index	UBS Diapason Global Biofuel TR Index	Avg of S&P Global Clean Energy and Wilderhill Clean
Bache Commodity Green Index	1.00					
Bunge Four Blend Biofuel Price Index	0.78	1.00				
MLCX - Biofuels TR Index	0.89	0.81	1.00			
S&P GSCI Biofuel TR Index	0.88	0.78	0.97	1.00		
UBS Diapason Global Biofuel TR Index	0.89	0.76	0.97	0.99	1.00	
Avg of S&P Global Clean Energy and Wilder	0.60	0.61	0.48	0.38	0.43	1.00

4.2 Broad Commodity Indices

Relative to broader commodity indices, BCGI[SM] performance has been strong during the period since Jan 2007, with the BCGI[SM] showing modest but meaningful diversification benefits relative to commodities in general even during periods of substantial market contagion. To understand the relationship between the BCGI and other commodity indices, an equally-weighted composite of the Bache Commodity Index (BCI[SM]), the S&P GSCI Commodity Index, the DJAIG Commodity Index, and the Rogers International Commodity Index has been created ("Major Commodity Indices" composite). Figure 8 shows that the BCGI[SM] has had an annualized return of 5.8% during this time

period, whereas the commodity index composite has been down an average of -4.5% per year. Similarly, the maximum drawdown for commodity index composite exceeded the BCGI^{SM}, at -54.9% compared to -48.7% for the BCGI^{SM}.

Figure 8

Performance of Commodity Indices: Jan 2007 to May 2009

	Bache Commodity Green Index	Average of Major Commodity Indices**
Annualized Return	5.8%	-4.5%
Annualized Std. Dev.	27.4%	26.4%
Sharpe Ratio*	0.21	-0.17
Maximum Drawdown	-48.7%	-54.9%
Max Monthly Return	16.0%	15.2%
Min Monthly Return	-15.8%	-21.3%
Correlation with Bache Commodity Green Index	1.00	0.84

* Using 3-month T-Bill rate as risk-free rate

** Equal Weighted Portfolio of Bache Commodity Index, SPGS Commodity Index, DJAIG Commodity Index, and Rogers' International Commodity Index. Rebalanced monthly.

Over this period of market volatility, the BCGI^{SM} was highly correlated with the commodity index composite. Figure 9 below indicates that the correlation is .84.

Figure 9

Correlation among Commodity Indices (using monthly data from Jan 2007 to May 2009)

	Bache Commodity Green Index	Average of Major Commodity Indices*
Bache Commodity Green Index	1.00	
Average of Major Commodity Indices*	0.84	1.00

* Equal Weighted Portfolio of Bache Commodity Index, SPGS Commodity Index, DJAIG Commodity Index, and Rogers' International Commodity Index. Rebalanced monthly.

This substantial overlap in exposure during this period, as indicated by the high correlation between the BCGI^{SM} and the commodity index composite, suggests that the BCGI^{SM} may fit well within an institutional investor's commodity allocation without requiring the establishment a new investment sector. To investigate the effect of adding the BCGI^{SM} to an existing portfolio of commodity indices, a portfolio that is 10% allocated to the BCGI^{SM} and 90% allocated to commodities has been constructed. From Figure 10, it is evident that the addition of BCGI^{SM} to a basket of commodity indices results in higher returns (an additional 100 bps per annum), as well as reduces drawdown and volatility in an incremental manner.

Figure 10

Performance of Commodity Index Portfolio: Jan 2007 to May 2009

	Portfolio I: 90% Portfolio II and 10% Bache Commodity Green Index	Portfolio II: Portfolio of Major Commodity Indices**
Annualized Return	-3.4%	-4.5%
Annualized Std. Dev.	26.1%	26.4%
Sharpe Ratio*	-0.14	-0.17
Maximum Drawdown	-54.3%	-54.9%
Max Monthly Return	14.7%	15.2%
Min Monthly Return	-20.8%	-21.3%

* Using 3-month T-Bill rate as risk-free rate

** Equal Weighted Portfolio of Bache Commodity Index, SPGS Commodity Index, DJAIG Commodity Index, and Rogers' International Commodity Index. Rebalanced monthly.

The properties of the BCGI[SM] relative to traditional financial assets like stocks and bonds can also be examined. Figure 11 indicates that, since January 2007, the BCGI[SM] has outperformed traditional domestic (S&P 500) and international (MSCI World) equities (down 14% per year on average), but underperformed highly rated fixed income during a period of global flight to quality (+5% per year on average). The BCGI[SM] has exhibited a drawdown (-48.7%) that is comparable to global (-54.0%) and domestic (-50.9%) equities, but which has been greater the BCI[SM], but as indicated above, not greater than the portfolio of major commodity indices, on average.

Figure 11

Performance of Equity, Bond, and Commodity Indices: Jan 2007 to May 2009

	Bache Commodity Green Index	Bache Commodity Index	MSCI World Index U.S. Currency TR	S&P 500 TR Index	Barclays Capital Global Aggregate Bond Index (USD)	Barclays Capital US Aggregate Bond Index (USD)
Annualized Return	5.8%	7.7%	-14.2%	-14.5%	6.3%	5.6%
Annualized Std. Dev.	27.4%	18.1%	22.8%	20.7%	7.8%	4.3%
Sharpe Ratio*	0.21	0.30	-0.71	-0.82	0.38	0.47
Maximum Drawdown	-48.7%	-34.3%	-54.0%	-50.9%	-10.1%	-3.8%
Max Monthly Return	16.0%	11.6%	11.2%	9.6%	6.2%	3.7%
Min Monthly Return	-15.8%	-10.9%	-19.0%	-16.8%	-3.7%	-2.4%
Correlation with Bache Green Index	1.00	0.82	0.63	0.54	0.50	0.35

* Using 3-month T-Bill rate as risk-free rate

Figure 12 shows that the BCGI[SM] has been significantly correlated with the broad-based BCI[SM], but that its correlation relative to traditional stocks and bonds have been much lower, ranging from .35 for US fixed income to .63 for global stocks. This low correlation is indicative of diversification properties that commodities in general as well as the BCGI[SM] have relative to traditional assets. These correlations are comparable to the correlations of the equity indices relative to the fixed income indices (.30 to .47), for which there is a long-standing institutional acceptance of the diversification benefits.

Figure 12

Correlations (using monthly data from Jan 2007 to May 2009)

	Bache Commodity Green Index	Bache Commodity Index	MSCI World Index U.S. Currency TR	S&P 500 TR Index	Barclays Capital Global Aggregate Bond Index (USD)	Barclays Capital US Aggregate Bond Index (USD)
Bache Commodity Green Index	1.00					
Bache Commodity Index	0.82	1.00				
MSCI World Index U.S. Currency TR	0.63	0.52	1.00			
S&P 500 TR Index	0.54	0.41	0.97	1.00		
Barclays Capital Global Aggregate Bond Index (USD)	0.50	0.32	0.47	0.38	1.00	
Barclays Capital US Aggregate Bond Index (USD)	0.35	0.09	0.35	0.30	0.86	1.00

4.3 Major Assets

Adding the BCGI[SM] to a broad portfolio representative of traditional institutional investment allocations can have a beneficial impact. The benchmark portfolio is composed of a 60% allocation to the S&P 500, a 30% allocation to the Lehman US Aggregate bond index, and a 10% allocation to the BCI[SM] ("Portfolio II"). A portfolio that is 97% allocated to this benchmark portfolio, and 3% allocated to the BCGI[SM] has an increased return of 50 basis points per year over the period January 2007 to May 2009. Other key properties of the portfolio are essentially unchanged by this addition, including volatility, drawdown and correlation with traditional indices like the S&P 500 and the Barclays US Aggregate bond index.

Figure 13

Performance of Stock, Bond, and Commodity Portfolio: Jan 2007 to May 2009

	Portfolio I 97% Portfolio II, 3% Bache Commodity Green Index	Portfolio II 60% US Stocks, 30% US Bonds, 10% Commodities**
Annualized Return	-5.8%	-6.3%
Annualized Std. Dev.	13.8%	13.7%
Sharpe Ratio*	-0.62	-0.66
Maximum Drawdown	-33.5%	-33.8%
Max Monthly Return	6.0%	5.9%
Min Monthly Return	-12.0%	-11.9%
Correlation with S&P 500 TR Index	0.98	0.99
Correlation with BarCap US Aggregate Bond Index	0.38	0.38

* Using 3-month T-Bill rate as risk-free rate

** S&P 500 TR Index, Barclays Capital US Aggregate Bond Index, and Bache Commodity Index were used as proxy for US Stocks, US Bonds, and Commodities, respectively.

5. Conclusion

The BCGI[SM], a broadly diversified index capturing exposure to both biofuels and emissions reduction, is a benchmark for investment strategies that focus on alternative energy and the reduction of

greenhouse gases. It also offers investors a tool to gain direct exposure to a fast-growing sector of the commodity markets. Holding these commodities in the form of an index substantially reduces the risks associated with holding any single green commodity, and broadens the economic processes to which the holder of the index will be exposed. The BCGI^{SM} has performed well relative to Biofuel and Clean Energy indices of various forms. The BCGI^{SM} has also outperformed traditional commodities, while retaining the basic correlation structure with those other commodities. For example, adding the BCGI^{SM} in modest amounts to a broad commodity allocation over the period January 2007 until March 2009 would have resulted in meaningful increases in returns. Similarly, adding the BCGI^{SM} to a portfolio of traditional assets would have also increased returns for this same period.

Together, the results presented here suggest that the BCGI^{SM} offers an efficient vehicle for an investor seeking to make a forward-looking allocation to a growing segment of the global economy. It also offers the opportunity to improve the risk and return properties of a portfolio relative to either traditional commodities or more broadly, a diversified portfolio of stock, bonds, and commodities.

Appendix 1

Green Indices:

- **Bunge**

This index holds B100 and B20 biodiesel as well as E25 and E85 gasoline. The commodities included in the index include gasoline, heating oil, corn, sugar, and oilseeds.

- **MLCX Biofuels Index™**

The Index applies the Merrill Lynch Commodity Index methodology to futures contracts on physical commodities. Futures contracts on physical commodities that are either biofuels themselves or feedstock commonly used in the production of biofuels are considered for eligibility in the Index. Biofuels are transportation fuels derived from non-fossilized biological sources.

- **S&P GSCI Biofuel Index™**

The S&P GSCI Biofuel Index reflects the total returns that are potentially available through an unleveraged investment in an index of four commodity contracts (corn, soybean oil, wheat and sugar) with specific weights applied to each of these contracts.

- **UBS Diapason Global Biofuel Index™**

The Index covers a range of commodities used in the production of ethanol and biodiesel. The Index, which is composed of various commodity futures, is weighted to reflect the importance of each individual commodity used in the production of ethanol and biodiesel as well as the liquidity of the underlying futures.

Equity Indices:

- **S&P Global Clean Energy Index™**

The S&P Global Clean Energy Index includes 30 of the largest publicly traded stocks from companies involved in clean energy, from around the world. The index is comprised of a diversified mix of Clean Energy Production and Clean Energy Equipment and Technology companies.

- **WilderHill Clean Energy Index™**

The Clean Energy Index is comprised of approximately 54 companies which are publicly traded in the United States and engaged in a business or businesses which the Clean Energy Index Selection Committee believes stand to benefit substantially from a societal transition toward use of cleaner energy and conservation.

Appendix 2

Detailed Global Green House Gas (GHG) Flows