BEETLE CAPITAL

THE 2020
RACE TO POST OIL

EXECUTIVE SUMMARY

The '2020 Race to Post Oil' is a precursor to a more detailed report, 'Investing in Natural Capital', which we will publish in the spring. Here, we outline Beetle Capital's vision of a world moving towards a post oil economy over the next ten years. This paper discusses this transition in the context of several critical trends:

- The race for resources
- The rise of 'natural capital'
- The decline of globalism and the rise of nationalism
- Peak oil versus post oil
- The electrification of transportation
- Securing a competitive advantage: the United States v. China

The next ten years will witness changes of great magnitude – changes driven by population growth; by competition for water, food, land and energy security, and by the greening of GDP. Without a roadmap, it will be difficult for most investors to adjust their asset-allocation strategies to these new and changing conditions. In order to take these coming risks and opportunities into account, we are proposing an investment framework built around the concept of natural capital, the combination of the world's renewable and non-renewable resources.

Our key investment themes for the next decade are:

- Less Oil – the electrification of transport will decouple GDP growth from oil.
- More Electrification – the electrification of transport will have a dramatic impact on oil prices, trade balances, and the valuation of the automotive and related industries.
- More Technology – increased energy efficiency, new means of power generation and storage, and 'smart' electrical grids made possible by cutting-edge technologies will create new business models in the energy industry.
- More Efficient Resource Use – innovation which uses resources efficiently will affect investments across the board, from energy and mining to forestry and commodities.
- More Water for Energy – more and more water will be needed to generate power from new and old sources.
- Less Energy for Water – innovation will be needed to make water collection, processing, distribution, and end-use more efficient.

The new world energy order will mean more growth for some countries and less for others. Investment paths will become less clear or predictable as disruptive technologies and government policies impact mature industries such as utilities and autos. Ultimately, however, innovations and efficiencies in all sectors of the economy should allow us to make the best use of natural capital and to grow sustainably – and profitably.

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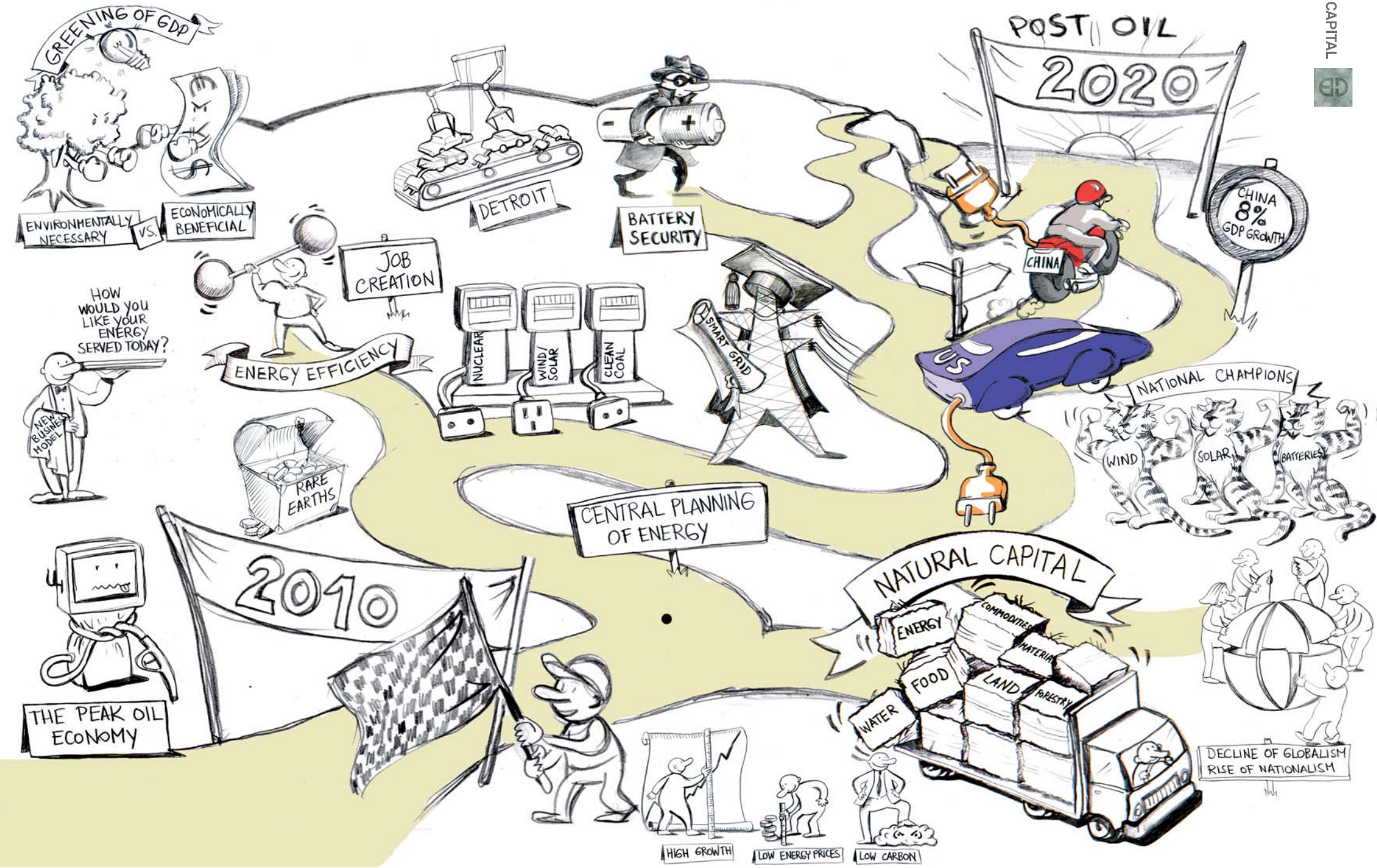

GREENING OF GDP
ENVIRONMENTALLY NECESSARY
VS.
ECONOMICALLY BENEFICIAL
DETROIT
BATTERY SECURITY
POST OIL
2020
CHINA 8% GDP GROWTH
CHINA
US
JOB CREATION
HOW WOULD YOU LIKE YOUR ENERGY SERVED TODAY?
ENERGY EFFICIENCY
NUCLEAR
WIND/ SOLAR
CLEAN COAL
SMART GRID
NEW BUSINESS MODEL
RARE EARTHS
NATIONAL CHAMPIONS
WIND
SOLAR
BATTERIES
CENTRAL PLANNING OF ENERGY
2010
THE PEAK OIL ECONOMY
NATURAL CAPITAL
ENERGY
COMMODITIES
MATERIALS
FOOD
LAND
FORESTRY
WATER
DECLINE OF GLOBALISM
RISE OF NATIONALISM
HIGH GROWTH
LOW ENERGY PRICES
LOW CARBON

INTRODUCTION: THE RACE FOR RESOURCES

The world is between cycles, moving from an era of growth to an era of uncertainty. The growth paradigm of old was straightforward enough, marked by rapid technological innovation, globalisation, and cheap energy. The world is now headed towards economic conditions that will entail not only cyclical but structural change: a damaged financial sector, an overstretched consumer base, rising energy prices, and shortages of water, food and other natural resources so severe that they could heighten global and regional tensions. These factors, combined with new and external ones like carbon pricing, all point to one thing: a crisis of confidence in growth.

It's less clear what lies over the horizon. This is true across the economy as a whole, but it's especially true for energy-intensive sectors. For investors, increased state involvement in power generation and transportation presents both an opportunity and a risk. Government policies and fast-changing technologies have the potential to dismantle the traditional drivers of economic growth, replacing them with a more sustainable model. These shifts will unfold in fits and starts, with some countries surging ahead and others lagging behind. The speed of these step changes will depend directly on the extent to which national governments, with their policies and their investment, underpin the transformation of their energy sectors.

One thing is certain: the world is entering a new cycle of creative destruction in which new policies and new entrepreneurs will radically transform the vast complex of energy-related industries over the course of decades to come[1]. The hand-in-hand correlation of economic growth and energy, which has been the case for decades, is coming to an end. It will be recast as a much broader relationship between growth and natural capital. Increasingly, discussions around materials, around commodities, and around food and water security – not just energy – will dominate the investment debate. This is a true paradigm shift, for the greening of GDP can help offset the forces that lead to the rising depletion of natural resources. Without such a shift, investments, particularly in emerging markets facing resource shortages, could well suffer from lower than expected growth rates – shortfalls which have not yet been factored into valuations by investors.

What is coming is a 21st Century version of an arms race: a race for energy, commodities, food, and water. The facts are plain. Take just one: the voracious Chinese economy, by some estimates, will consume more than half of the world's key resources within a decade[2]. The way forward is equally plain: it is our ability to reduce oil dependency and optimise natural capital through policy and technology which will create competitive advantages in the post oil economy. For investors, the energy race requires a fundamental rethinking of how to frame asset allocation in the context of a resource-constrained world. To do that, we must refocus the investment prism – away from narrow verticals like carbon or clean technology and towards a more holistic framework built on maximising the return from natural capital.

[1] *C. Perez, Technical Revolutions and Financial Capital, the Dynamics of Bubbles and Golden Ages (Cheltenham: Edward Elgar Publishing, 2002).*
[2] *D. Robertson, 'China's Growth Could Spark Political Tensions'. The Times Online, 28 January 2008.*

The resource race will take us to a very different place. The old and new worlds rest on very different pillars, as Table 1 suggests.

Table 1
Characteristics of peak and post oil economy

Peak Oil	Post Oil (the long run...)
Golden Era of Free Trade	Bilateral Trade Agreements and Carbon Tariffs
Resource consumption	Resource efficiency (energy, food, land and water)
OECD driven	Emerging markets driven
Mobile communications	Mobile power (electric vehicles)
Reliance on foreign oil	Reliance on foreign batteries
Oil based transport	Electrification of transport
One-way Grid	Smart Grid
Energy prices go up	Energy prices could go down
Water is free	Water is priced
Microprocessor-based	Quantum or Nano-based
Carbon mitigation	Carbon adaptation

Source: Beetle Capital

NATURAL CAPITAL

Sustainable growth is about more than simply energy and carbon. It is about optimising all of our natural capital – water, commodities, food, land, forests and even renewable resources such as wind. Built around the Kyoto framework, current climate-change policies focus on carbon and renewable energy, ignoring the crucial natural capital connection. And yet the speed with which countries move to the forefront of change by taking a whole-systems approach could materially impact not only their domestic economies but also their global competitive positions. How governments integrate natural resource use and depletion into their policy planning will affect not just energy, but also resources like food and water.

Investment portfolios in the market today do not take into account the risks and opportunities linked to natural capital. They underestimate the importance of water to energy production, for example. When talking about sustainable growth as an investment theme, it's not enough to go on and on about the shift to higher-growth emerging markets; that's been overplayed. Sustainable growth is more fundamental, and more complicated, than that. Achieving sustainable growth will cause an uncomfortable realignment in global balances of power, with conflicts likely to emerge over water, food, and arable land. How nations integrate natural resource use and depletion into their policy planning will affect both their energy security and the sustainability of their economic growth.

Emerging markets, for instance, face long-term issues around natural capital depletion that on a country-by-country basis may dramatically affect their growth profiles over the next decade. Water demand-and-supply imbalances may be massively heightened by population growth, urbanisation, and climate change. In emerging markets such as China, Africa, and India, overall water scarcity is already a critical problem. From 1988 to 2004, China experienced GDP declines of 1.2% and 0.8% because of drought and flooding, respectively[3]. In southern Africa, drought caused an income drop of over 8% in areas where agriculture makes up nearly half the local economy[4]. Indian farmers are using nearly 80% of their country's available water, largely from groundwater wells. At current rates, the World Bank estimates, India will have exhausted available water supplies by 2050[5]. Water is central to the discussion of natural capital – to the point that the world's populations will

increasingly be asking themselves whether they want water for food or for growth. Water, or the lack of it, will force the world to make tough choices, and the constraints water places on growth will greatly impact investments over the next two decades. The 2009 World Economic Forum 'Water Initiative Report' states that between now and 2030 water supplies for agriculture will be squeezed as the water needs of cities and industry grow. The increase in demand from industrial and domestic users will 'crowd out any growth in agriculture water use' between 2000 and 2030. In Asia, a '65% increase in water for industrial use and 30% increase in water for domestic use is forecast, against a 5% increase in water for agriculture'[6].

The water-energy connection is crucial. Thermal power plants – from coal and nuclear to solar and waste-incineration – depend heavily on water; they account for a staggering 39% of freshwater withdrawals in the United States[7] and 31% in the European Union[8]. The only way to offset this demand is to produce clean energy with water-efficient technologies.

An increased reliance on renewable energy, however, may exacerbate water shortages in some regions of the world if the transition towards renewables is not carefully managed. Table 2 below ranks various energy-generation technologies in terms of water demand. When compared to traditional coal plants, alternative technologies like carbon capture and storage (CCS) and biomass increase water demand by 4% for CCS and 64% for biomass. However, if a greater proportion of wind generation is added to the mix, if energy-efficiency measures are implemented, and if consumers choose electric vehicles instead of biofuel-powered cars, water consumption actually goes down substantially, even assuming greater use of CCS. The lesson is that power generation must be viewed not in parts, but as a whole.

WATER INTENSITY OF ENERGY SOURCES

Ranking of Water Efficiency	Ranking	Closed Loop (Gallons/MWh)	Open Loop (Gallons/MWh)	Wt Avg Water Demand * (Gallons/MWh)
Wind / Solar	1	-	-	0
Solar Thermal	2	1,000	1,000	1,000
Other Ren	3	3,000	3,000	3,000
Natural Gas	4	300	20,000	3,000
Oil	5	800	50,000	9,068
Nuclear	6	1,000	55,000	15,000
Coal (w/o CCS)	7	800	50,000	20,000
CCS	8	1,500	50,700	20,700
Biomass	9	32,891	32,891	32,891

* Weighted towards the mix of open or closed loop processes for existing plants

Source: Beetle Capital and Lux Research

[3]*E. Lin and J. Zhou, 'Climate Change Impacts and Its Economics in China: Contributions to the Stern Review', HM Treasury, 2006.*
[4]*N. Stern, 'The Economics of Climate Change, Chapter Four, The Implications of Climate Change of Climate Change for Development', HM Treasury, 2006.*
[5]*J. Briscoe and R.P.S. Malik, 'India's Water Economy Bracing for a Turbulent Future', The World Bank, (New Delhi: Oxford University Press, 2006).*
[6]*World Economic Forum, Water Initiative, 'Managing our Future Water Needs for Agriculture, Industry, Human Health and the Environment', 2009.*
[7]*World Economic Forum, Energy Vision Update 2009, 'Thirsty Energy Water and Energy in the 21st Century'.*
[8]*DHI, 'A Water for Energy Crisis? - Examining the role and limitations of water for producing electricity', 2007.*

THE DECLINE OF GLOBALISM AND THE RISE OF NATIONALISM

The U.N. Climate Change Conference in Copenhagen in December was a tipping point. Across the new divide, the self-preservation of national economies will trump even the noblest efforts to develop a binding global policy framework to reduce carbon emissions. The failure of Copenhagen to nail down such an agreement can be traced in part to the 'polluter pays' principle: you broke it, you fix it; those nations which built their industrialised economies on carbon are those which should take the lead in repairing the damage. The problem with policy by noblesse oblige is that it works fine in a strong global economy but not in a weak one – not when those same developed nations are desperate to find a new business model to keep themselves prosperous through the next decade.

In order for global carbon policy to work, it needs to address outdated economic models of growth and consumption. Following an era of free trade and high resource consumption, all the old assumptions are being called into question. Globalisation assumed a world of abundant resources, but you can only move rice and oil seamlessly across borders at the lowest cost when you have plenty of them; when you don't, you can't.

On the surface, what seems to be needed is a major rebalancing of growth between the consumers (particularly in the United States, which represents more than 16% of global GDP) and the producers (China and the rest). The problem with global rebalancing is that as a result of the financial crisis and the ensuing global recession, consuming nations have reduced their consumption while the producing nations haven't increased consumption enough to pick up the slack. Moreover, from a resource perspective, rebalancing is a zero sum game: it merely shifts energy-related consumption and jobs from one part of the globe (developed) to another (developing). It does not contribute to GDP growth, energy security or climate change solutions.

The status quo is not the answer either. The high dependence on oil for transportation, to cite one example, poses serious national security threats, exacerbates trade imbalances, and negatively impacts consumers and industries through rising prices. The world is outgrowing the system which rewards cheap labour and high energy use; indeed, that very system could actually lead to less consumption and less growth in future. Economies need to take the carbon out of energy and the energy out of GDP in order to generate sustainable growth. It can be done by moving away from the wrong products (SUVs versus electric vehicles) powered by the wrong fuel (oil versus electricity) and manufactured in the wrong places (at great distance versus close to home).

Getting there will be expensive. The world will need to deploy massive amounts of capital – $37 trillion, according to the International Energy Agency[9] – in order to engineer a complete overhaul of the way we produce and consume energy. From an investor's perspective, the infrastructure requirements for the scale of the overhaul which will have to take place are undoubtedly large, dwarfing the $488 billion invested globally in clean energy from 2002 to 2008[10].

The greater challenge will be to identify rapidly evolving sectors which are ripe for investment and to pinpoint when to make those investments. Key to making the right decisions, therefore, will be the rate at which relatively new technologies can be deployed at scale, thereby creating cost competitiveness and accelerating the S-curve of innovation adoption.

Changing a country's energy mix is like turning around a slow moving oil tanker – it takes a long time. The power generation sector is characterised by long replacement cycles and high capital intensity. A stable, long-term global carbon price could in theory help to underwrite risky infrastructure investments, particularly in nuclear and CCS. But global policy efforts to date have failed to produce a carbon framework which passes the test of 'materiality' from an investment perspective: so far, so what?

National policy will be a far more telling signal to investors. Ultimately, investors will flock to countries and sectors where there is a clear national policy-planning framework. In some cases, central planning will make large-scale projects feasible; in others, national treasuries will be providing the right kind of funding. This sort of framework will arise, nation by nation, out of competitive considerations such as energy security or the desire by governments to create new 'national champions' in emerging industries. From this standpoint, as we discuss later in this paper, the auto sector, which lies outside the current scope of global policy discussions like Copenhagen, presents lower hurdles to investors.

PEAK OIL VERSUS POST OIL

Over the last decade, the world has moved closer and closer to peak oil – from a world characterised by high growth, lower energy prices, and high carbon to one of lower growth, higher energy prices and high carbon as the rate of oil production approaches the point of terminal decline. The correlation between GDP growth and energy prices is well established. International Monetary Fund analysis has demonstrated that an oil price decline of 10% over the course of a year can boost global GDP by 1%[11]. Figure 2 gives a clear picture of the inverse relationship between energy prices and GDP growth between 1980 and 2008.

FIGURE 2

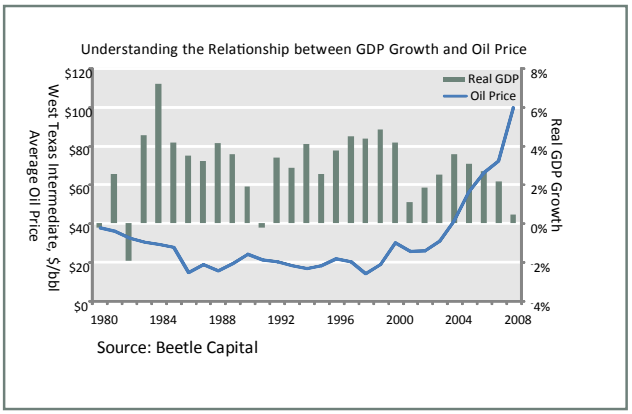
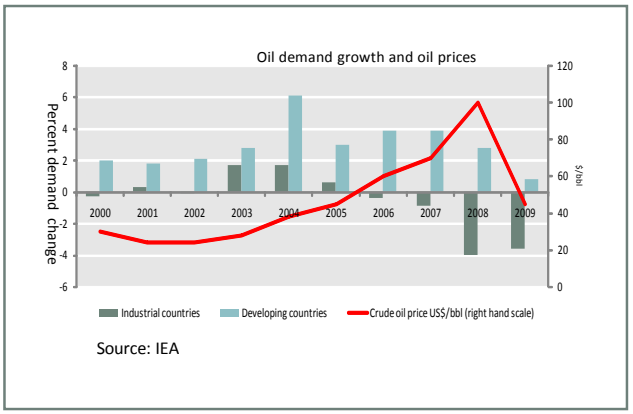


FIGURE 3



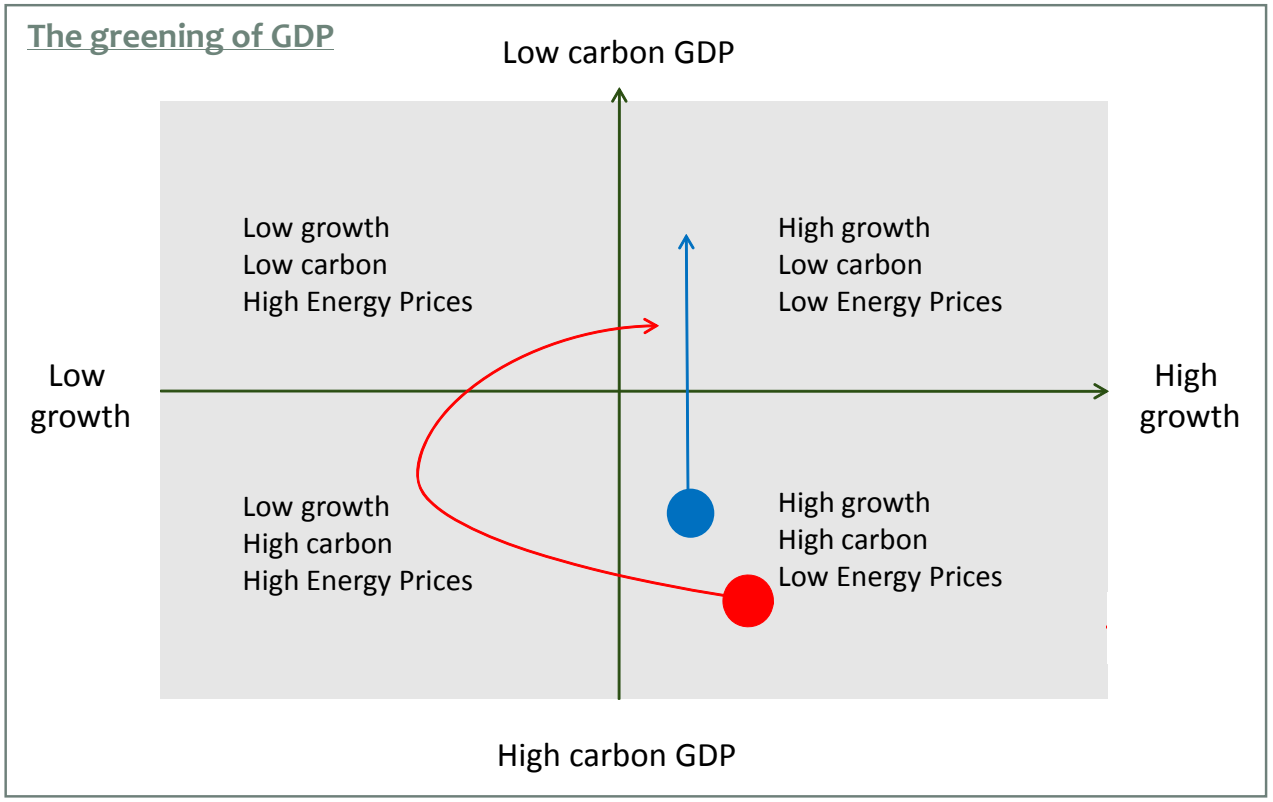
But the relationship between oil prices and global GDP is by no means linear. It's affected by a number of factors, including a government's willingness to use subsidies to mitigate oil price swings. A recent report by the IMF suggests that government subsidies in developing economies have to an extent protected consumers from the effects of higher oil prices[12]. As Figure 3 indicates, this was not the case in advanced economies, where the pass-through of higher prices was faster and hit harder.

[9]International Energy Agency, 'World Energy Outlook', 2009.
[10]New Energy Finance.
[11]International Monetary Fund, 'Economic Shifts and Oil Price Volatility', March 2009.

In a world of peak oil, where the correlation between oil and growth is assumed to be strong, not everyone is always impacted in the same way. According to an IMF World Economic Outlook report in April 2009, the redistribution of purchasing power from commodity exporters to commodity importers due to falling commodity prices in 2009 could be as high as 1.5% of GDP. This shift is significant: its impact on consumer spending and global growth is roughly equivalent to the fiscal stimulus programmes implemented in many countries[13].

The ups and downs of oil and other commodity prices and the effects of stimulus packages are temporary. The greening of GDP affords a more permanent way forward, one which can lead to structurally higher growth, lower energy prices, and lower carbon emissions. A carbon-light economy, where GDP has been decoupled from oil prices, is one step towards to a more stable and sustainable economy. According to the McKinsey Global Institute, a 25% drop in overall energy consumption by 2020, relative to business-as-usual growth, would bring about a corresponding 27% reduction in carbon dioxide emissions[14]. But less carbon is only part of the answer. The rest comes from greater energy efficiency, drawing on the proper utilisation of the world's natural capital.

FIGURE 4



Source: Beetle Capital

[12] *J. Lipsky, 'Economic Shifts and Oil Price Volatility', International Monetary Fund, March 2009.*
[13] *World Economic Outlook, 'Crisis and Recovery,' International Monetary Fund, April 2009.*
[14] *D Farrell, S. S. Nyquist and M. C. Rogers, 'Making the Most of the World's Energy Resources', McKinsey Global Institute, 2007.*

Figure 4 depicts the greening of GDP as an energy-productivity matrix. To achieve sustainable growth, the global economy must move from the lower right-hand quadrant to the upper right-hand quadrant: from energy inefficiency (high growth, high carbon and low energy prices) to energy efficiency (high growth, low carbon and low energy prices). Getting there may mean rising energy prices in the medium term. For one thing, there's the likelihood of a carbon tax on dirty energy. For another, there's the higher cost of renewable energy at the outset, before economies of scale have had a chance to kick in. But in the longer term, there's the prospect of lower energy costs.

One positive step towards an energy-efficient post oil economy will come from the introduction of disruptive technologies like electric vehicles. The proliferation of EVs, combined with higher fuel-efficiency standards, could undermine oil demand to the extent that even lower oil prices wouldn't cause demand to return to earlier levels. That, after all, is the fundamental point of disruptive technologies: demand for a new product is not reversed even by a price collapse of the old one. A recent report by Deutsche Bank, 'The Peak Oil Market', underscores this point. It suggests that oil prices and demand may peak in 2016 initiating a final shift to less oil-intensive renewable sources and more energy-efficient products and services, such as electric vehicles. Demand will decrease and prices will also decline, but the lower prices will not stimulate a return to oil-intensive technologies[15].

THE ELECTRIFICATION OF TRANSPORTATION

Vehicular electrification has been and will continue to be an economic game-changer. By 2030, according to estimates by The University of California, Berkeley, Center for Entrepreneurship and Technology estimates, up to 24% of all cars on U.S. roads could be EVs[16]. In our model, we assume that by 2030 20% of U.S. electricity generation will come from renewable resources[17] and that U.S. Corporate Average Fuel Economy efficiency standards for fuel-based cars will by that time be raised from 25 mpg today to the proposed EU levels of 58 mpg[18].

A 24/20 scenario has important implications. First, according to research by the Pacific Northwest National Laboratory, electricity prices could decline or at least stay constant due to better power generation capacity utilisation enabled through significant penetration of EVs[19]. Second, on our estimates, the 24% EV scenario would trigger a 13% reduction in oil consumption and a 20% reduction in U.S. oil imports, exerting further downward pressure on oil prices. Finally, the U.S. would experience a 2% reduction in carbon emissions since EVs are almost four times more energy-efficient than fuel-based cars and their greenhouse gas emissions are approximately 75% lower[20].

The implications of electrification in the U.S. are significant. The recent U.S. 'cash for clunkers' programme – in which a buyer was given $4,200 on average to trade in an old vehicle for a new, more efficient one – was based on a stimulus of only $2.9 billion, and yet it added 0.5% to U.S. GDP growth in the 3rd quarter of 2009[21].

The global implications of even modest electrification are enormous. By 2030, the number of automobiles worldwide will increase by two and a half times, from 812 million today to 2.1 billion. The growth rates are expected to be highest in developing countries; China, for example, could experience an 11.1% compound annual growth rate compared with a global average of 3.4%.

[15]Deutsche Bank, 'The Peak Oil Market: Price Dynamics at the End of the Oil Age', 2009.
[16]University of California, Berkeley, Center for Entrepreneurship and Technology, 'Electric Vehicles in the United State, A New Model with Forecasts to 2030', 2009.
[17]Based on straightlining North American Electric Reliability Corporation 2018 figures to 2030, '2009 Long Term Reliability Assessment 2009-2018', October 2009.
[18]Emissions limits of 95g/CO2 per km by 2020 have been proposed for European cars. The equivalent fuel efficiency for cars in the United States is 58mpg.
[19]M. J. Scott, M. K. Meyers, D. B. Elliott, and W. M. Warwick, 'Impacts Assessment of Plug-in Hybrid Vehicles on Electric Utilities and Regional US Power Grids Part 2: Economic Assessment,' Pacific Northwest National Laboratory, November 2007.
[20]Credit Suisse, 'Electric Vehicles: Back to the Future', October 2009.
[21]L. J. Miller and M. Babic, Bloomberg, "U.S. 'Clunkers' Add 0.5 Percentage Point to GDP", August 2009, www.bloomberg.com/apps/news?pid=20601109&sid=a3PfAN0nL3Is.

THE RACE TO ACHIEVE GLOBAL COMPETITIVE ADVANTAGE

In our view, China will likely come first in the race against the United States to create a green economy and champion national leaders in new industries. China and the U.S. share the view that reducing their dependence on fossil fuels is an investment in new technologies and business models as well as a job-creation opportunity. Research and development, where the U.S. enjoys great strengths, is one route to a competitive advantage, led by advances in energy-efficient technologies, EVs and batteries, not to mention renewables like solar (where the U.S. holds 4,500 patents to China's 500) and wind (2,750 patents versus 1,250). The U.S. has previously spent more on R&D and holds more cleantech patents than China (although this lead is not unassailable with China's government spending on cleantech R&D projected at $397 billion between 2009 and 2013, compared with $197 billion in the U.S.[22]). On the other hand, China's ability to impose central planning (through its Five Year Plans) on energy production and related industries puts it ahead of the U.S. and other countries. China has a significantly more powerful and centralised national regulatory system than the U.S., regulating only six major utilities versus several thousand.

FIGURE 5

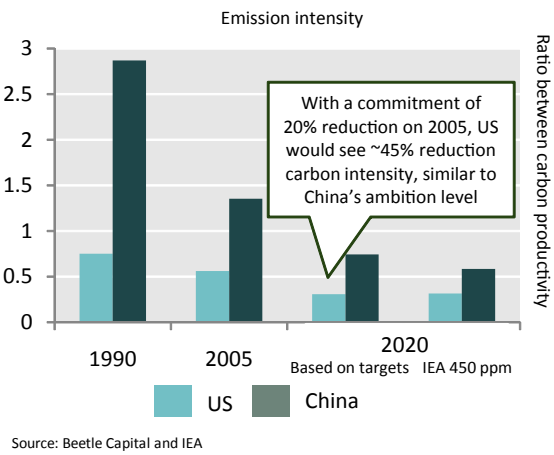
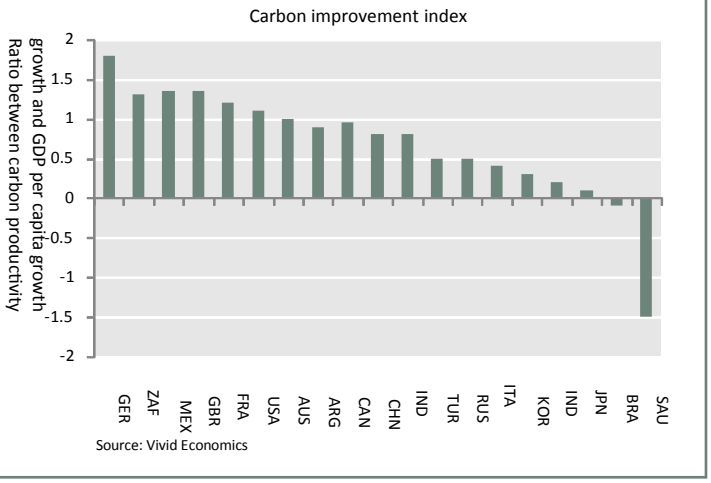


FIGURE 6



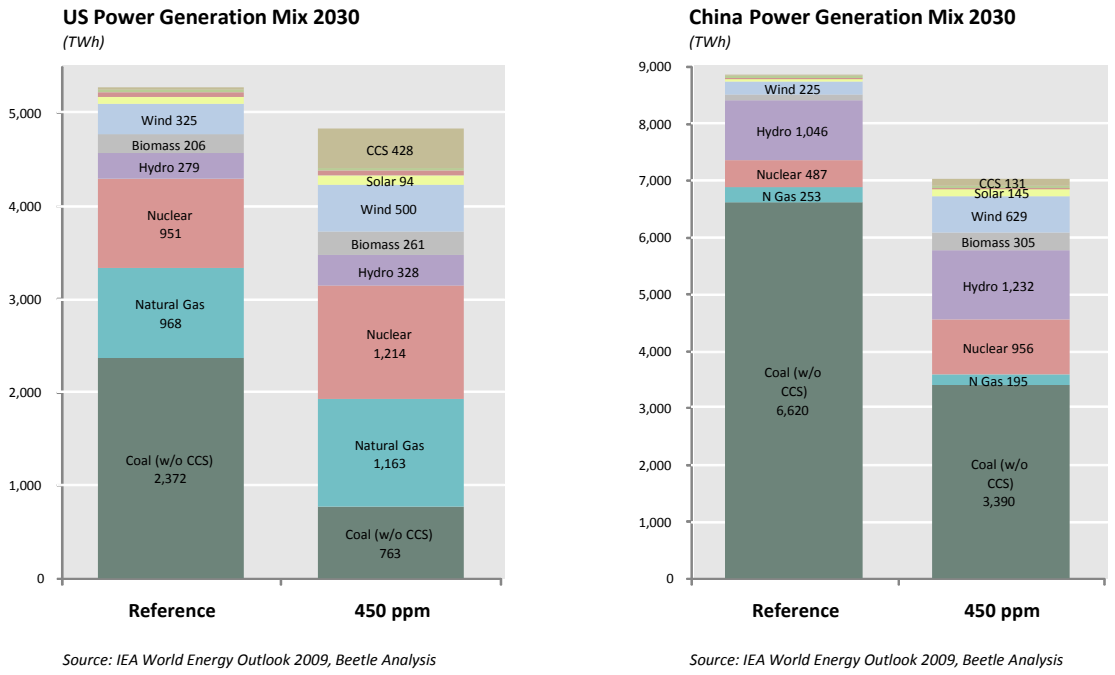
Historically, China's rapid economic growth has been fuelled by rapacious energy demand. Reducing its dependence on coal for energy production is secondary to keeping annual GDP growth above 8%. This explains China's pre-Copenhagen commitment to reduce carbon emissions by 40% to 45% per unit of GDP: the announced targets will deliver a billion-tonne reduction in carbon[23](similar to the U.S.), but overall emissions will go up because of China's high growth rate and its dependence on coal. (See Figure 5.) This explains why China's carbon productivity – the ability to increase the amount of GDP obtained from each unit of carbon (or carbon equivalent) emissions – is now and will continue to be for some time well below that of the U.S. and other developed economies. (See Figure 6.)

The differences between the U.S. and China are even more apparent in their current and projected power generation profiles. If China continues to conform to the IEA Reference Scenario which assumes an energy mix similar to today's, its demand for energy will rise by 22% by 2030. If, however, China grows at the same rate but implements the IEA 450 ppm scenario (meaning a carbon dioxide level of 450 parts per million in the atmosphere), it will have to reduce its energy consumption through efficiencies and by lessening its reliance on coal in favour of nuclear and wind. (See Figure 7.) Under the IEA 450 ppm assumptions, China appears to lead the U.S. in terms of restructuring its energy-production complex, although its emissions intensity will still be higher.

[22]Breakthrough Institute, 'Rising Tigers, Sleeping Giant: Asian Nations Set to Dominate the Clean Energy Race By Out-Investing the United States'
[23]Beetle Capital, 2009.

But the IEA's 450 ppm scenario raises some questions. It is by no means certain that global targets will be met even by those nations which sign up to them. In the U.S. (and in most countries excluding China), there is little coordination between energy policy and climate-change policy. The supposed goal to reduce overall emissions has not been accompanied by anything like central planning of energy production. As with other countries which lack China's centralised control mechanisms, the ability of the U.S. to implement effective nationwide climate-change policies remains in doubt. Given the many other things on the Obama Administration's to-do list, the fate of U.S. climate-change legislation remains in doubt.

FIGURE 7



China's priorities are clear. Beijing wants to continue developing its industrial base and to secure access to valuable resources - at home and abroad. In order to protect its emerging wind and solar equipment industries, for example, China has imposed local-content requirements in both sectors. In recent years, China's requirement that wind turbines be built with 70% local content forced many European manufacturers to build factories in China and set up joint ventures or technology licensing agreements with Chinese firms. In November 2009, the Chinese government lifted this requirement, but by this time most of the big manufacturers had already established a local presence, and much of the technical knowledge had arguably already been transferred.

The lifting of the requirement looked very much like a pre-emptive strike to prevent retaliation against Chinese manufacturers now seeking to enter the U.S. wind market. In the event, a pattern is evident. China more recently introduced an 80% local content requirement in connection with the construction of its first utility-scale solar power plant.

Beijing clearly does not want to be left behind in the global scramble for commodities. In order to increase its nuclear power generation capacity to 100 GW or more by 2030, China has made a series of direct investments in uranium producers in Australia. China's appetite is not just nuclear. By next year China is expected to be consuming 35% of the world's iron ore supplies; aluminium, 30%; zinc, 25%; copper, 23%. Taking advantage of deflated global prices, China is importing and stockpiling nickel and other base metals on the cheap.

Storing up its own natural resources for long-term gain, China over the last five years has cut back on exports of so-called rare earths – elements used in the manufacture of high-tech devices from superconductors to hybrid-car batteries. Its aim: to secure its place as a top manufacturer of components critical to new technologies. China currently accounts for 93% of the production of rare earths like dysprosium and terbium, which are vital to a wide range of energy-related technologies including motor manufacturing, laser production, and military hardware[24]. Over the past five years, China has reduced its export quotas for these elements by 50%. This strategy gives its high-tech industries a chance to grow while gaining a competitive edge over rivals in Asia, Europe and America. Hoping to force foreign companies to move their high-tech factories and research centres to China, Beijing has generated a rare-element trade surplus and ring-fenced an industry tipped to supply the global post oil economy.

CONCLUSION

The race to post oil represents a new set of risks and opportunities for investors. Asset-allocation strategies will need to reach new levels of sophistication – moving away from a narrow focus on vertical sectors like cleantech and towards a more broad-gauged approach which integrates natural capital and the energy complex. Investors will have to see the world through multiple lenses, including some that cast a different and unexpected light on value. Ultimately, the greening of GDP will be disruptive, but often in a constructive way, providing returns on investment across geographies, asset classes, and sectors.

The emerging natural capital market presents a unique backdrop:

- **Energy prices. Now for the most part inversely correlated with economic growth, they may decline in the long run as a result of:**
  - energy efficiency
  - the electrification of transport
  - the addition of new renewable sources of power generation

- **A new global dynamic in which national interest circumvents the global good in order to secure access to the valuable resources which feed growth**

- **Disruptive (and largely positive) changes to mature industries such as utilities and autos, including:**
  - fundamental changes in the growth rates and business models
  - creation of new industrial 'national champions'
  - opening up of oligopoly markets to new competition

- **A lack of clarity on the future of carbon reduction because of:**
  - the failure to marry global carbon policy with national energy plans
  - the limitations of incremental policy when transformational change is needed
  - the near impossibility of reversing trends in population growth and industrialisation

[24] *K. Bradsher, 'China Tightens Control on Rare Earth Minerals'. The New York Times, 31 August 2009.*

- **A structural deterioration in the risk profile of some emerging markets if their prospects for economic growth are adversely affected by their dependence on certain resources.**

Most investors have yet to position their portfolios or investment strategies to account for resource scarcity, energy security, and the greening of GDP. These are not lenses we're accustomed to wearing. They take us even further beyond our comfort zone than the credit crisis or the many other issues with which we are grappling today. Sustainable investing requires a more disciplined and systemic approach to modelling and valuation. In the post oil economy, economic models or investment strategies that do not employ a natural capital framework will underperform.