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Investment Implications of a "Carbon Bubble"

This paper is a response to a position paper presented at the Oxfordshire County Council Pension Fund Committee meeting of Friday December 5th, 2014, suggesting that the council and other local authorities divest from conventional energy producers and focus their energy investments on renewables. It was proposed that such an approach should be considered due to the risks of a "carbon bubble" which results in these companies not being allowed to produce their resources and suffering large losses as a result of changes in carbon policy.

This response will assess the economic implications of a global cap on carbon emissions upon the economics of energy companies. While there will be a lot of political compromises involved should a carbon limitation be enacted, the economic implications of a comprehensive carbon emission limitation are more nuanced that the picture painted by those advocating a carbon bubble with the result that the investment guidance provided could have very poor results for those funds that follow their recommendations.

For the purposes of this paper we will assume as fact, 3 major premises of carbon bubble advocates.

The first is that global warming is caused by human emissions of greenhouse gases primarily CO2 and methane (CH4). The second is that scientists are able to accurately calibrate this process and that the IPCC estimates on the amount of carbon that can be burned to hold global warming at less than 2 degrees are correct, and the third is that this implies that something like 2/3 of existing and forecast hydrocarbon reserves must be left in the ground to keep the earth from warming unsustainably.

To these premises, we will add some basic science, some economics and some unpleasant truths. We will start with the inconvenient truths. The truths are the following:

1) Global food production is highly dependent on the use of hydrocarbons both as fuel for planting and harvesting and as fertilizer. Prior to the development of hydrocarbons, agriculture was never able to generate enough food to support a human population above 2 billion people and did so using the direct labour of a large portion of the population. As late as the early 1900's, 25-30% of a much smaller global population lived on farms or worked in the agricultural sector and that was even with coal being extensively used to transport agricultural products by rail. The development of hydrocarbons enabled a step change in agricultural productivity via mechanized agricultural and extensive usage of artificial fertilizers which allowed global population to rise even as the proportion of the population involved in agriculture fell dramatically. This implies that we may have to keep using fossil fuels in this area if we want to maintain our current societal arrangements

2) Fossil fuels, particularly oil, appear to be quasi irreplaceable for some functions. Oil particularly is unique among energy sources due to its high energy density, storability and easy usage. This makes it very hard to replace in some uses such as aircraft and ground transport. While society is working on substitutes, we would venture to say that none of us would feel comfortable boarding a battery powered aircraft right now . Likewise, the military always puts a reliable diesel engine on its nuclear

submarines even as it spends billions on the nuclear propulsion unit due to the dependability of oil based engines.

3) Global society has built a massive capital stock that uses hydrocarbons. When you include roads, bridges etc. one can argue that the majority of the global economy's capital stock was built to use hydrocarbons with the investment in oil related capital stock (vehicles, ships, airplanes, roads, ports, cities, airports etc.) being most important. This is not an investment that we can easily abandon without drastic economic losses. In order to maintain a high standard of living, societies are going to need to get as much use out of this investment as possible while we transition into new energy technologies.

Now for some basic science on carbon emissions. The basic science is the following: According to many sources including the UN Intergovernmental Panel on Climate Change, natural gas emits approximately 45% the total carbon emissions per unit of power generated compared with coal, with oil generating about 75% of what coal would emit for the same quantity of energy or work. Thus natural gas is far more carbon efficient than coal, and even oil is moderately more carbon efficient than coal. The importance of this will be discussed below.

Once you combine the inconvenient truths with the science of carbon emissions using current technologies, the economics of carbon reductions become fairly obvious. Energy using capital stock is built based on extremely long useful lives ranging from 10 -30 years for vehicles, 40 years or more for ships and aircraft and 40 years + for power plants, which means that new technologies will have little impact over the intermediate term and implies that society is going to have to adjust near term and intermediate term carbon usage with the technologies we have today. This makes the economics of reducing carbon emissions very clear: any solution to reduce CO2 emissions will require the curtailment of overall energy usage and the near total elimination of coal as a fuel source with its replacement by natural gas. It will also involve renewables as much as possible but with current technologies, renewables cannot reduce carbon emissions as much as eliminating coal. It may also involve a major expansion of nuclear power if its other environmental and economic challenges can be overcome or if society makes a decision that the significant environmental hazards of nuclear power are acceptable in order to prevent global warming.

The investment implications of this are far more nuanced than the case presented by carbon bubble advocates who appear to be advocating that pension funds sell conventional energy companies to make renewables investments that don't really exist among listed equities and which have a very poor track record as investments.

In a world where remaining fossil reserves are 1) limited due to carbon constraints and 2) desperately needed to feed 7 billion people and to make the best possible use of the world's already existent oil dependent capital stock, what is likely to actually happen is complicated, but it seems likely that end user prices for fossil fuels will rise dramatically. Who gains from these price rises will depend on political compromises but it seems likely that reserves that can be used without exceeding the overall carbon limit, particularly gas, will actually rise in value while it is likely that reserves that can't be used, such as coal assets, will lose all value although even this is not clear since there may be some compensation paid to holders of these assets. Existing renewables assets

may gain higher prices for their output, however most of these assets are regulated so their returns are capped by law resulting in little gain for their owners. Companies which can build new renewables assets could see greatly expanded business opportunities and more value, however this is a business where few companies have much competitive advantage so these gains are likely to be competed away resulting in limited investment gains. Historically the renewables sector has been incredibly volatile and very treacherous for investors even with heavy government incentives and there is no reason to believe that this will change just because the sector gains further policy favour.

In terms of the oil companies cited specifically by carbon bubble advocates, these companies are actually likely to be modest winners in a carbon constrained world. As oil companies these firms don't produce coal and they have actually moved dramatically towards producing natural gas in recent years due to their inability to find oil at affordable prices. Since these companies already have relatively short reserve lives and a large portion of their reserves are gas, they are likely to have few if any assets rendered unviable and will gain scarcity value for what they retain. Furthermore, the stock market already views these companies sceptically, and only values them on a discount to their proved reserves and not on the larger resource numbers cited by carbon bubble advocates.

In the energy sector, the biggest losers in a carbon restriction accord will be holders of coal reserves (mostly China, USA and Russia), coal companies, and Venezuela whose vast tar reserves will probably never be able to be developed in such a scenario. China and Chinese coal companies are actually the biggest losers as China's economy relies heavily on coal and will be severely impacted by a comprehensive carbon limitation accord. India and Australia will also suffer significantly as coal is very important to their economies. Russia and OPEC nations may suffer as well as the carbon restriction may imply that they are not able to fully produce all of the oil reserves that drive their economies. For a variety of reasons related to short reserve life and an inability to find oil in recent years, the relatively insignificant (in global terms) independent Western oil sector that is quoted on global stock markets is actually likely to escape most of the negative implications of carbon restrictions and may actually benefit as the restrictions hit the world's large hydrocarbon holders (primarily China, Russia and OPEC). While the Western majors seem to epitomize "big oil" in the minds of the public they are actually quite small in the big scheme of things and are likely to escape most negative impacts due to their very limited reserve holdings.

To give a case study of why we see this counter intuitive result, let us look at the biggest integrated oil major, Exxon. Exxon holds 20 billion barrels equivalent of reserves, predominantly gas, which are mostly slated to be produced over the 20 years and which would probably face few if any problems under a carbon restriction regime. Venezuela on the other hand, may have as much as 700 billion barrels of oil reserves slated to be produced over the next 100 years. As such they are a large holder of dirtier oil reserves they are likely to face some restriction particularly on the reserves that could be produced 50 years from now.

Investment implications are actually more dramatic and negative for industries outside of the energy sector. In a world where fossil fuel prices rise dramatically due to long term constraints, consumers will be the biggest losers as energy intensive goods and services will be more expensive. Industries that lose large amounts of energy as inputs are likely to dramatically downsize and will face many bankruptcies. For example it is almost impossible to foresee airline and travel sectors as large as

those we see today in a world where carbon usage is sharply curtailed. In a world where carbon emissions are sharply curtailed and focused on feeding people adequately, it is going to be hard to justify jetting off to Thailand for the holidays. Energy intensive goods will be much more expensive and some business models like Walmart's (produce energy intensive goods in China and sell them in the West) just won't work anymore as their full energy cost will be felt by consumers.

In summary, even if we take the premises of carbon bubble advocates as 100% true, we strongly disagree with their conclusions. The view of the world that they are advocating is overly simplified and it appears that they have done very limited economic analysis. We believe that following their investment recommendations could be very dangerous to pension fund holders and recommend that fund fiduciaries analyse the situation very carefully before making broad decisions on how to allocate their pension assets.