

Building Limited Fossil Energy Supplies into the World Monetary System

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Richard Douthwaite

1. The Problem

Where did humanity go wrong? When did we take a path which, because 'one path leads to another' in Robert Frost's phrase, inexorably led us to becoming totally dependent on a grotesquely unsustainable economic system? To put this another way, why is our way of life under threat from the way we generate our livelihoods?

Humanity's story is better regarded as a progression rather than progress, although if we stick with the latter term, the qualifier 'rake's' comes to mind. Its key feature over many centuries is that people have moved from simple ways of organising themselves and supplying their needs to much more complex ones. For example, the shift 10,000 years ago from hunter-gathering to depending on settled agriculture was obviously a step from a simple to a more complex way of life. It was also a step that, in turn, allowed even more complex ways of living to develop. It led to towns and cities, to specialists and priesthoods, to the development of the notion of private property, and, as a result of that notion, to the rule of the many by the few. With settlement came crafts such as pottery, and then literature, science, most music and art, each an example of greater complexity.

Complexity can be measured. One way is to count the number of roles that people play. Hunter-gatherer societies are said to contain no more than a few dozen distinct social personalities, while modern European censuses recognise 10,000 to 20,000 unique occupational roles, and industrial societies may contain more than a million different kinds of social personalities overall. Another way of measuring is to count the number of different artifacts in daily use. Compare, for example, the number of lines sold in a typical shop in an Indian village – salt, sugar, rice, beedis, matches and very little more – with that in a modern European or North American supermarket which could well have 15,000 different products on display. Sainsbury's flagship store on the Cromwell Road in London sells 40 different types of apple, six varieties of caviar, 50 different teas, and 400 forms of bread. "Someone came in on Christmas Eve and asked for banana leaves," a keen young manager told a journalist recently "and you know something? We had them."

The transition from one level of complexity is always marked by an increase in energy use. In earlier days, this usually meant that people had to work harder. Farmers had to spend more time growing food than hunter-gatherers had had to spend on collecting it. Bushmen apparently only had to collect food every third or fourth day.

There's no evidence that the transition from hunter-gathering to settled agriculture was the fatal mistake we are looking for in the sense of it marking the start of a system that would have eventually proved unsustainable. After all, it did survive for thousands of years anyway,

despite many local unsustainabilities along the way, such as the steady decline of irrigated farming yields in Mesopotamia because of the increasing salt content in the soil. (The lower crop yields caused by the salt meant that the human energy required to run the complex system could not be maintained. There was too little food to operate the Sumarian bureaucracy and, more importantly, its army, which led to the state's conquest and collapse.)

In my view, the wrong turn was taken in England in the 16th Century as the population began to recover from the Black Death. The increased numbers – a rise from 1.6 million to 5.5 million in less than 200 years - naturally put greater pressure on resources and caused communities to have problems living within the limits imposed by their local environments. In 1631, Edmund Howes described how this had forced them to start to burn coal:

Within man's memory it was held impossible to have any want of wood in England. But ...such hath been the great expence of timber of navigation, with infinite increase of building houses, with great expence of wood for household furniture, casks and other vessels not to be numbered, and of carts, wagons and coaches, besides the extreme waste of wood in making iron, burning of bricks and tiles, that at this present, through the great consuming of wood as aforesaid, and the neglect of planting of woods, there is so great scarcity of wood throughout the whole kingdom that not only the City of London, all haven towns and in very many parts within the land, the inhabitants in general are constrained to make their fires of sea-coal or pit coal, even in the chambers of honourable personages and through necessity which is the mother of all arts, they have in late years devised the making of iron the making of all sorts of glass and the burning of bricks with sea-coal and pit-coal.

That was it. The thin end of the wedge. The slippery slope. For the first time, humanity was starting to depend on a non-renewable, and hence unsustainable, energy source for its comfort and livelihood. It was understandable that it did. Which of us would have worried about the long-term consequences of burning black stones collected from beaches in Northumberland, or which had been dug out of shallow holes in the ground?

As the demand for coal increased, the easiest, shallowest mines were soon exhausted, and deeper and deeper pits had to be dug. This posed enormous problems since, if a shaft is sunk below the water table, it floods and a pump has to be installed to keep things reasonably dry. The early pumps consisted of rags or buckets on continuous chains which were turned by horses or, if a stream was handy, a water wheel. However, the deeper a shaft went, the longer the chain had to be and the more friction the horse or the wheel had to overcome. As this placed a real limit on how deep a mine could go, mine-owners were keen to find other ways of powering their pumps. Around the time Edmund Howes was writing, coal-fired steam power began to be used for the first time for pumping water out of mines. In a somewhat incestuous way, coal energy was being used for mining coal.

The first steam engines just moved a piston back and forth, which was all that was required to work a cylinder-type pump. It was only during the following century that the piston was attached to a crank to turn a revolving shaft, an innovation in response to a demand for rotary power from cotton mills unable to find additional sites for their waterwheels. This was the type of engine, of course, that powered the industrial revolution and led with an alarming inevitability to the problems we have today. It was steam power, in fact, which made the widespread use of machines both necessary and possible.

The essence of industrialisation is that it produces lower-cost goods by using capital equipment and external energy to replace the skilled, and thus relatively expensive, labour

used in hand crafts. Since less labour is used per unit of output, unemployment develops unless sales expand. The mechanisation of sock and lace production in the English midlands led to such widespread job losses that riots broke out in 1811 and 1812. Troops were sent to the area to stop the Luddites, as the bands of destitute working men were called, from breaking into the new factories and destroying the machines. Indeed, had the Napoleonic War not ended in 1815 allowing the factories to increase their sales in Europe and elsewhere, the disturbances might have become serious enough to kill off the industrial revolution. Without wider markets, firms using powered machinery would have either consumed themselves in a competitive frenzy, or seen their technologies banned as a result of popular unrest.

Eventually, British imports put most continental craft producers out of business and left the remainder with no alternative but to adopt mechanised methods too. In some cases, the surviving producers received state grants to help them re-equip, such as those given to the ironworks and engineering companies owned by the Cockerills in Belgium after that country became independent from France in 1830. More generally, however, governments, or leading public figures, helped them acquire the new technology by organising - and sponsoring - demonstrations of the latest British equipment. Tariff barriers were maintained to allow the new continental industries to build themselves up until they could not only compete with their British rivals but had acquired export markets in which to sell themselves. It was the need for exclusive external markets to solve the problem of mass unemployment at home that led the European powers to scramble to assemble competing empires and eventually to confront each other in the First World War.

In a sales pyramid the early participants get rich because they receive commission on the goods they sell to people whom they have persuaded to become dealers too; dealers who, in turn, can earn a commission from others they induce to join the pyramid as dealers later on, who themselves recruit and stock further dealers. And so it goes on, setting up a situation in which everyone in the pyramid can only fulfill their income aspirations if the pyramid does the impossible and expands indefinitely, eventually involving infinitely more people than there are in the world.

The machine-production system became dominant by expanding on exactly the same lines. Just as British factories had needed to take over the markets previously served by craft-scale manufacturers in Europe to survive, industrial Europe had to oust artisanal producers elsewhere in the world, and the British sold them the machinery to do so. As each successive group of countries was forced to adopt mechanised production methods themselves in the hope of escaping poverty, so those who had mechanised earlier sold them the equipment. And so the industrial pyramid grew and grew until it reached the point some years ago when there were no more markets supplied by craft producers to take over. This left firms in the pyramid with no one to displace but each other, and since then, international competition has become much more intense.

Firms have adopted two strategies to survive: one is to automate, eliminating the need for human labour almost entirely. The other is to move production to countries where labour is cheap. The combined result of the two is that the share of industrial revenues being paid in wages and salaries has fallen rapidly and larger and larger numbers of people are being left without the financial means to buy manufactured products. In more than 100 countries, average per capita incomes are lower today than they were 15 years ago, and more than a quarter of humanity -- 1.6 billion people -- is worse off now than it was then. In Britain, the

proportion of national income being paid in wages and salaries fell from 72% in 1974 to only 63% in 1995, an unprecedented fall in so short a time.

In short, the machine-based production system is proving itself to be unsustainable on two counts. One is that, because manufacturing companies are racing against each other to achieve ever-lower costs, the system is progressively denying its worker-customers the incomes they need to buy its products. It is thus curtailing its own markets and imploding. With surplus production capacity in almost every sector, the world is now poised on the brink of an economic collapse more serious than that in the 1930s. It is not that there is no demand for the additional products the factories could produce. The potential market is huge. It is just that because of the low wages and high levels of unemployment, those who would like to consume more do not have the income to express their demand.

The second source of unsustainability is the topic of this conference. It is that the fossil energy that made mechanisation and globalisation possible is beginning to get scarce. There is still plenty of coal in the ground, of course, but in energy terms, the amount of coal required to produce coal has climbed and climbed. It has been calculated that American strip-mined coal only produces 2.5 times the amount of energy required to mine it when it is burned if scrubbers are fitted to remove sulphur dioxide from the smoke so as not to cause acid rain.

The same is true for other fossil fuels – the amount of energy required to find and extract them is taking an increasing share of the energy they produce. Once energy input equals energy output, the fuel in the ground might as well not be there. This is the reason that the world's oil production from conventional sources is expected to peak within the next five or six years. As we have heard in earlier papers, output will then fall away so that by 2050, it will be around the level it was in 1950, but having to be shared out among four times as many people. It might be possible to exploit unconventional oil sources like the Athabaska tar sands, but the extraction techniques developed so far require too high an energy input to make the process profitable. Moreover, even if a better method of extraction was found, it would only ease oil supplies for a few more years. With gas, the situation is even more serious. World output is expected to peak around 2020 and then go into a steep decline.

So we are coming to the end of our dalliance with fossil-fuel-powered machines and it's going to be a sticky one. All the systems of production and distribution that have been built up over the past two centuries are going to have to be radically changed, and there is only a limited amount of usable fossil energy left to bring about the transformation.

Looking back, it is impossible to see a point at which humanity was presented with a clear choice of paths to take and chose the wrong one. The first people to burn coal found it harmless enough even if the smoke from it was unpleasant. It was better than being cold. Then, once a few manufacturers started subsidising their production by using coal as a source of power, everybody had to do so as well or be driven out of business. Even in the early days, no one had the option of standing aside. The attraction of low prices was so great that although Napoleon organised a blockade during the war with England, he was unable to prevent smuggled imports of cheap British goods destroying jobs in France and elsewhere. The Luddites came the closest to stopping mechanisation

Only within the past few years has it become evident to those with open minds that fossil energy shortages will either cause our complex economic and social system to collapse or bring about its total transformation, This was not something for Edmund Howes and his

contemporaries to worry about in 1631 particularly as, even today, most people deny the energy problem if they think about it at all. Those that do assure themselves that something - cold fusion, perhaps, or fast breeder reactors - will be developed in time to save the day. Hard technologies and greater complexity, they expect, will come to our rescue again.

The general response to the other threat to the system's sustainability, the stifling of market demand by the concentration of purchasing power in ever fewer hands, is no more enlightened. Although Marx and Engels wrote that capitalist industrial production was unsustainable because of its own internal contradictions as long ago as 1848 and the widening gap between rich and poor caused the depression in the 1930s, the system which has now led to 1.5 billion people living on less than a dollar a day is still being touted as the best – indeed the only – way that the deprived can eventually fulfill their needs in the global marketplace.

The conventional view that the poor need to be able to sell things to the rich in order to earn enough to rise out of their poverty is expressed by people who are well aware that the energy and resources for such a course to be successful just aren't available, as it would take six – or is it eight? - planets for the world's present population to live sustainably at current North American levels. These people also know that the rich generally have enough already and the real needs are felt by the poor themselves. Even the poor rarely mention the obvious solution – a global redistribution, fairer shares for all – as it would make them seem either Left-wing fanatics, simple minded or hopelessly idealistic. What everyone lacks is an intellectually respectable alternative way.

2. Towards a Possible Solution

So where do we go from here? We need a solution that :

1. Cuts fossil energy consumption rapidly so that a sustainability crisis we haven't mentioned so far, global warming, is dealt with before serious damage is done to the world's climate.
2. Ensures that enough fossil energy reserves remain for humanity to make the transition to an advanced economy powered almost completely by renewable energy sources. Since it involves re-casting a lot of the systems that have built up since the Industrial Revolution, the investment of a lot of energy will be required for this radical transformation.
3. Redistributes resources to the poorer parts of the world to alleviate poverty there and thus provides a better market for the goods from richer countries. This is not required for idealistic reasons but because it is likely to be impossible to achieve global sustainability otherwise.

Colin Campbell has already suggested what might happen as a result of increasing oil scarcity if no action is taken. He expects the five big OPEC producers in the Middle East – Saudi Arabia, Kuwait, Iraq, Iran, and the United Arab Emirates – to take advantage of their growing share of the world's oil production and to put up prices sharply. He's probably right but even if OPEC doesn't increase prices in a year or two, normal market mechanisms will do so a few years later anyway; the moment demand outpaces the contracting supply.

In either case, the result will be the same: oil producing countries will get such a huge increase in earnings that they will be unable to spend it all on additional imports. As in 1973,

they will have no option but to lend their surplus back to the countries from which it came either by depositing it in western banks or by investing it in western stock and bond markets.

This process inevitably increases in global indebtedness but, unless countries and corporations can see some prospect of being able to repay the extra loans, they will not be prepared to take them on. This would cause interest rates to fall but, as Japan has shown in the past four years, even zero interest rates might not be low enough to make extra borrowing attractive. A global slow-down could result, making borrowing even less attractive, and the situation could quickly be reached in which more debts were being repaid than new ones taken out. This would cause the world's money supply to contract and usher in a global depression, cutting oil demand and bringing its price down. This might stimulate a mild recovery but if oil demand rose again to the maximum output level, prices would soar once more and the world economy would move back into depression. In other words, under the business-as-usual scenario, there is every chance that the level of global economic activity will contract in step with the decline in oil supplies. Constant contraction and depression could be the norm. Even the oil producers would not do well because for a lot of the time, their output would be being sold in depression conditions.

There might be no way that the free market could break out of this cycle once it started because the price of oil that tipped the world into depression might not be high enough or maintained for long enough to encourage investment in renewable energy sources. Then, once the world had slumped into a depression and oil was cheap again, the market would provide no incentive to reduce dependence on the fuel, at least on a significant scale. The world could descend into chaos and misery, unable to help itself.

If such a scenario is a possibility then the energy markets need to be modified in some way so that they can deliver a better result. What does a group of dishonest antique dealers do before an auction? They decide who is to bid for each item and the maximum they are to pay and then, afterwards, they hold a private auction among themselves to determine who actually gets what. The point of this ploy is to ensure that the extra money which would have gone to the vendor if the dealers had bid against each other in the original auction stays within the group and does not leak away unnecessarily to a member of the public. Something similar could be done for oil. A buyers' ring could be set up to prevent excess money going to fossil fuel producers in times of scarcity and plunging the world into an economic depression.

A digression is necessary to explain how one might work. If a country is to enjoy the maximum sustainable level of well being, it needs to decide which scarce resource places the tightest constraint on its economy's development and expansion. It should then adjust its systems and technologies so that they automatically observe the limits imposed by that constraint. In terms of our discussion so far it might seem that oil and gas were the scarcest factors of production at present but I don't think that's true. Labour and capital are not the critical factors either. There is unemployment in most countries and, in comparison with a century ago, the physical capital stock is huge and under-utilised. On the other hand, the natural environment is grossly overused especially as a sink for human-made pollutants. The Intergovernmental Panel on Climate Change (IPCC) believes that 60-80% cuts in emissions of one category of pollutants - greenhouse gases - are urgently needed to bring them into line with the planet's capacity to deal with them and thus lessen the risk of humanity being exposed to the catastrophic consequences of a runaway global warming. Accordingly, anyone who believes that a catastrophic climate change is most serious threat facing

humankind at present should want their economic system to be adapted so that it treats the Earth's capacity to remove greenhouse gases from the atmosphere as the scarcest resource and ensure that the normal workings of the economy act to reduce that threat.

Contraction and Convergence (C&C), a plan for reducing greenhouse gas emissions developed by the Global Commons Institute in London which has gained the support of a majority of the nations of the world, provides a way of linking a global currency with the limited capacity of the planet to absorb or break down greenhouse gas emissions. C&C involves the international community agreeing how much the level of the main greenhouse gas, carbon dioxide (CO₂), in the atmosphere can be allowed to rise. There is considerable uncertainty over this. The EU considers a doubling from pre-industrial levels to around 550 parts per million (ppmv) might be safe while Bert Bolin, a former chairman of the IPCC, has suggested that 450 ppmv should be considered the absolute upper limit. Even the present level of roughly 360ppm may prove too high though, because of the time lag between a rise in concentration and the climate changes it brings about. Indeed, in view of this lag, it is worrying that so many harmful effects of warming such as melting icecaps, dryer summers, rougher seas and more frequent storms have already appeared.

Choosing a concentration target

Whatever CO₂ concentration target is chosen automatically sets the annual rate at which the world must reduce its present greenhouse emissions until they come into line with the Earth's capacity to absorb the gas. This is the contraction course implied in the Contraction and Convergence name.

Once the series of annual global emissions limits have been set, the right to burn whatever amount of fuel this represents in any year would be shared out among the nations of the world on the basis of their population in an agreed date – 1990, perhaps. In the early stages of the contraction process, some nations would find themselves consuming less than their allocation, while others would be consuming more, so under-consumers would have the right to sell their surplus to more energy-intensive lands. This would generate a healthy income for some of the poorest countries in the world and give them every incentive to continue following a low-energy development path. Eventually, most countries would probably converge on similar levels of fossil energy use per head.

But what currency are the over-consuming nations going to use to buy extra CO₂ emission permits? If those countries with reserve currencies such as the dollar, the pound sterling and the euro were allowed to use them, they would effectively get the right to use a lot of their extra energy for free because much of the money they paid would be used to provide liquidity for the world economy rather than purchasing goods from the countries which issued them. To avoid this, Aubrey Meyer of GCI and Feasta, the Dublin-based Foundation for the Economics of Sustainability, have devised a plan under which a new international organisation, the Issuing Authority, would assign Special Emission Rights (SERs, the right to emit a specified amount of greenhouse gases and hence to burn fossil fuel) to national governments every month according to their entitlement under the Contraction and Convergence formula.

Energy ration coupons

SERs would essentially be ration coupons, to be handed over to fossil-fuel production companies in addition to cash by their customers - electricity producers, oil refineries, coal

distributors and so on. An international inspectorate would monitor producers to ensure that their sales did not exceed the number of SERs they received. This would be surprisingly easy as nearly 80 per cent of the fossil carbon that ends up as manmade carbon dioxide in the earth's atmosphere comes from only 122 producers of carbon-based fuels. The used SER coupons would then be destroyed.

I don't need to tell this audience that such a system is not impossibility. Considerable work has already been done towards the development of an international trading system in carbon dioxide emission rights both at a theoretical level and in practice in the United States, where trading in permits entitling the bearer to emit sulphur dioxide into the atmosphere has led to a rapid reduction in discharges at the lowest possible cost.

Besides the SERs, the Issuing Authority would supply governments with a new form of money, emissions-backed currency units (ebcus), on the same per capita basis. It would announce that it would always be prepared to sell additional SERs at a specific ebcu price. This would fix the value of the ebcu in relation to a certain amount of greenhouse emissions and make holding the unit very attractive as other monies have no fixed value and SERs are going to become scarcer year by year.

The ebcu issue would be a once-off, to get the system started. If a power company actually used ebcus to buy additional SERs from the Issuing Authority in order to be able to burn more fossil energy, the number of ebcus in circulation internationally would not be increased to make up for the loss. The ebcus paid over would simply be cancelled and the world would have to manage with less of them in circulation. This would cut the amount of international trading it was possible to carry on and, as a result, world fossil energy consumption would fall. On the other hand, there would be no limit to the amount of trading that could go on within a single country using its national currency provided it kept its fossil energy use down.

Governments could auction their monthly allocation of SERs from the Issuing Authority to major energy users and distributors in their own country and then pass all or part of the national currency they received to their citizens as a basic income. (Something along these lines would be necessary as the price of energy would go up sharply and the poor would be badly hit) They could also sell SERs abroad for ebcus. The prices set by these two types of sale would establish the exchange rate of their national currency in terms of ebcus, and thus in terms of other national currencies.

The use of national currencies for international trade would be phased out. Only ebcu would be used among participating countries and any countries that stayed out of the system would have tariff barriers raised against them. Many indebted countries would find that their initial allocation of ebcu enabled them to clear their foreign loans. In subsequent years, they would be able to import equipment for capital projects with their income from the sale of SERs.

This type of dealers' ring would ensure that, rather than a lot of money being paid to the producer-countries for scarce oil and gas as a result of competitive bidding between prospective purchasers; it would go instead poor countries after an auction for their surplus SERs. This money would not have to be lent back into the world economy as would happen if the energy producers received it. It would be quickly spent back by people who urgently need many things that the over-fossil-energy-intensive economies can make.

So, rather than debt growing, demand would, constrained only by the availability of energy. Suppose it was decided to cut emissions by 5% a year, a rate that would achieve the 80% cut

the IPCC urges in thirty years, the sort of goal we need to adopt. Cutting fossil energy supplies at this rate would mean that the ability of the world economy to supply goods and services would shrink by 5% a year minus the rate at which energy economies became possible and renewable energy supplies were introduced. Initially, energy savings would take the sting out of most of the cuts – there's a lot of fat around - and as these became progressively difficult to find, the rate of renewable energy installations should have increased enough to prevent significant falls in global output.

The global economy this system would create would be much less liable to a boom and bust cycle than the present one for two reasons. One is that, as the shape of every national economy would be changing rapidly, there would be a lot of investment opportunities around. The other is that the supply of the world's money, the ebcu, would not fluctuate up and down as happens now, magnifying changes in the business climate. Their amount would be stable or, if the demand for fossil fuels rose so much that the emissions target was threatened, in slow decline.

Everyone, even the fossil fuel producers, would benefit from such an arrangement and, as far as I am aware, no other course has been proposed which tackles the problem in a way which is both equitable and guarantees that emissions targets are met. What is certain is that the unguided workings of the global market are unlikely to ensure that fossil energy use is cut back quickly enough to avoid a climate crisis in a way that brings about a rapid switch to renewable energy supplies.

This is not to say that we should abandon the market. Far from it. The C&C/ebcu/SER arrangement uses the market's powerful mechanisms to deliver results we all want. It puts us back on a path we mistakenly abandoned four hundred years ago and which now has the potential to take us to a sophisticated, sustainable world with a high degree of equality and complexity.

But will we, can we, change paths quickly enough? The near-certainty is that, if we stay on the current one for just a few years longer it will remove all our choices and make life for the majority of us terribly simple. And nasty, brutish and short.

Richard Douthwaite, Cloona, Westport, Ireland. ++ 353 98 25313.