How to Make Do and Mend our Economy

Rethinking Investment Strategies for Construction and Industry to meet the Challenge of Sustainability.

Jonathan Essex

Green House is a think tank founded in 2011. It aims to lead the development of green thinking in the UK.

Politics, they say, is the art of the possible. But the possible is not fixed. What we believe is possible depends on our knowledge and beliefs about the world. Ideas can change the world, and Green House is about challenging the ideas that have created the world we live in now, and offering positive alternatives.

The problems we face are systemic, and so the changes we need to make are complex and interconnected. Many of the critical analyses and policy prescriptions that will be part of the new paradigm are already out there. Our aim is to communicate them more clearly, and more widely.

We will publish a series of reports and briefings on different subjects. We do not intend to have a party line, but rather to stimulate debate and discussion.

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Green House Post-growth Project

Everyone agrees that we are in the midst of a massive financial and economic crisis. We have suffered the biggest crash since the 30s, and it may get far bigger yet. How ought this ongoing crisis to be understood, and resolved?

There is the mainstream view: we have vast government deficits, and stagnant economies. We have a dire need for economic growth – and a deep-set need for austerity, bringing with it massive cuts in public services.

But what if that diagnosis, which reflects mainstream wisdom, is all wrong? What if the crisis that we are currently experiencing is one which casts into doubt the entire edifice of capitalist economics that sets growth as the primary objective of all policy? What if the fight between those who say that without austerity first there can be no growth and those who say that we must invest and borrow more now in order to resume growth is a false dichotomy – because both sides are assuming 'growthism' as an unquestioned dogma?

The aim of the Green House Post-growth Project is to challenge the common sense that assumes that it is 'bad news' when the economy doesn't grow and to analyse what it is about the structure of our economic system that means growth must always be prioritised. We need to set out an attractive, attainable vision of what one country would look like, once we deliberately gave up growth-mania – and of how to get there. And we need to find ways of communicating this to people that make sense, and that motivate change.

Green House Post-growth Project Reports

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‘Joined up Economics: The Political Economy of Sustainability, Financial Crises, Wages, Equality and Welfare’ by Brian Heatley.

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‘How to Make, do and Mend our Economy: Rethinking Investment Strategies for Construction and Industry to meet the Challenge of Sustainability’ by Jonathan Essex.

‘A new Post-growthist Common Sense: Challenging the Hegemony of Growthist Discourse’ by Rupert Read.

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Summary

'Anyone who thinks you can have infinite growth in a world that is actually finite, is either mad or an economist.'
Sir David Attenborough, Radio 5, 4th February 2005, quoting Kenneth Boulding.

This report is about how 'building' a post-growth future cannot take for granted building in the literal sense: building comes at a huge ecological cost and tends to drive up consumption in all other areas.

The current economic strategies proposed to restart economies across Europe are reflected in two largely disparate policy debates: one around the nature of investment to kick-start growth, and another concerning whether or not there is a need for austerity measures to cut public sector deficits in many European states. This paper recognises that both of these mainstream approaches are failing: not just to produce a sustainable economy, but socially and environmentally too.

This report presents a framework that enables both of these challenges to be addressed together, thus extending far beyond current efforts to produce greener businesses and construction. Such a single green economic approach has been considered under the banner of a Green New Deal, but this is often viewed as a specific green employment and energy efficiency investment programme, rather than a wider strategy to enable the transition of our economy to a sustainable future. Here, we propose that such a shift from post-crash economics to a sustainable future must also mean shifting from continued expansion in the scale of our built environment (both in the UK and globally), to prioritizing creation of new green jobs that sustain our existing resource use, and keep industrial products in circulation.

This proposes we create a circular economy that reverses current trends of continued expansion in both the scale of resource *and* fossil fuel use, to recreate a reasonable chance of us remaining within 2^0C of global warming. To achieve this we must avoid emitting no more than *one fifth* of all already proven reserves of oil, gas and coal listed by companies and countries. Therefore, an end to fossil fuel subsidies and divestment of these dangerous-to-use assets is needed, alongside a reduced scale of other unsustainable levels of exploitation of our natural environment.

This will also require the removal of 'perverse' incentives that stop mainstream business being sustainable *enough*. We need to reduce the scale of our production and consumption and replace our cultural aspiration for 'more' possessions with making do with 'enough', and sharing more instead. In short, we need to make do, better, with less.

This is contrasted to current green industrial strategies, which tend to be incremental and fragmented, focussed: either on one business at a time or aiming to make an existing industrial process or construction greener but within the context in overall growth in the scale of production and consumption. Unfortunately, greener cars, greener electricity generation, greener consumer purchases in greener high-streets, alongside continued expansion of the scale of our built environment and global supply chains is still increasing, rather than reducing, our ecological and carbon footprints.

Therefore, a qualitatively different approach to continued 'development' is proposed. New capital investment should be reduced and reprioritised to that which delivers a positive ‘carbon payback’ which could be calculated in terms of the Energy Return on Energy Invested, (EROEI). As a result investment will focus more on improving *existing* capital; such as by refurbishment, repair and reuse; extending the life of resources already in circulation. We must aim to reduce the overall resource and carbon footprints associated with UK *consumption*, including the growing impacts associated with industrial production which is now relocated overseas.

This requires a refocusing upon maintaining and improving what we already have and investing in ‘intermediate’ technology that supports a transition to a renewed culture of sustainability. By focusing on development that delivers a positive carbon and resource 'return-on-investment' we will create jobs rather than expand physical capital.

Reconnecting our priorities to live within resource and climate constraints, can also make our society fairer, through a closer coupling of social and environmental outcomes. We will then finally have achieved sustainable development – having developed our societies to a state where our collective quality-of-life can be sustained as far as practicable within environmental limits.

Part 1: How Sustainable is our (Industrial) Economy?

The first part of this report briefly explores the current economy and pattern of development in the UK. It seeks to answer the question of why it is important to focus on capital investment: the construction of an ever expanding 'built environment' and industrial production capacity.

Firstly, investigating how the scale of our built environment (buildings and infrastructure) in the UK is changing, and how this compares to global trends;

Secondly, how this built environment impacts upon how much we (produce and) consume in the UK;

Thirdly, how capital investment relates to our current consumer economy, and the drivers of our current unsustainable economy; and

With this in mind, whether current approaches to green the economy in the UK go far enough.

2. How is the Scale of the UK's Built Environment Changing?

The public image of industry and construction in the UK might be summed up by how this section of our economy was depicted by Danny Boyle, the artistic director of the opening ceremony of the London Olympics in 2012. This ceremony depicted the destruction of England's 'green and pleasant land', presided over by one of our most recognisable engineering icons, Isambard Kingdom Brunel. An industrial landscape was then used by Boyle to introduce a celebration of not just the subsequent cultural and social history of the UK but the consumerism that this industrialisation led to.

However, the impact of construction on how much resources are used and wasted in the UK is not just historic. It remains still significant to this day. For example, the carbon emissions to construct the London Olympics venues and infrastructure totalled over a million tonnes of CO_2, at least as much as the whole of the rest of the impact of the Olympics, including all the flights associated with athletes and transport of spectators (Best Foot Forward, 2010).

The intensiveness of this continued process of physical development and urbanisation across the world is huge, but not often directly challenged. For example, the Chinese construction industry uses 28% of the energy and produces around 42% of China's greenhouse gas emissions with construction emissions in some of China's fast growing cities reported as being at least 50% of the total. This is unsurprising, as construction consumes vast amounts of material: with China using 40% of concrete and around one third of all steel globally. This is far greater, but very much connected to, the development that is increasing carbon emissions to manufacture consumer goods for export (and increasingly domestic consumption). Together, total industrial emissions (including construction) for China account for a half of China's carbon emissions, and close to a quarter in most 'developed' countries (Baoxing, 2007).

Such continued development has a major impact upon how we use what Schumacher (1973) described as our most precious resource: land. And this expanding nature of built development and construction and the carbon emissions this causes is by no means limited to so-called developing countries like China. While over 9% of England is already built on, the UK government has proposed this is increased a further 3% (Wintour, 2012). This aspiration is now reflected in a new National Planning Policy Framework which was drafted by developers (Hope, 2011).

The UK is still increasing the overall scale of its stocks of physical capital. For example, Linstead, Gervais and Ekins (2003) report a total of 291 million tonnes increase in physical capital in the UK in 1998 alone (more than 5 tonnes for each person), of which 95% was due to expansion of our 'built environment'. The actual scale of resource use this represents is even larger as noted by Smith et al (2003) – delivering this infrastructure required 420 million tonnes of resources, 363 million tonnes of which were incorporated into construction stock – the difference in these figures being waste during construction and demolition of existing stock. This is what 'living as if we have three planets

worth of resources' means in terms of the process of development.

Detailed analysis of the UK construction industry shows that around two-thirds of construction is new-build, the rest is repair and maintenance of what we have already (see Figure 1 below). This means, for example, that the scale of expenditure on new road construction exceeds all of existing maintenance, from potholes to resurfacing cost; *two-thirds of the construction industry is working to make the scale of our built environment bigger.* Similarly, new houses are built because we want more or bigger homes, not because existing buildings reach their end of their life (Thomsen and van der Flier, 2011).

We have created a society where ever more is thrown away, ever quicker. An economy that requires more and more input, that is kept (sustained) for less time before being thrown away, is, by definition, unsustainable. This is reflected in Heatley (this volume) whose analysis of the UK annual accounts shows that, on average, we write off all assets except housing every 15 years in the UK.

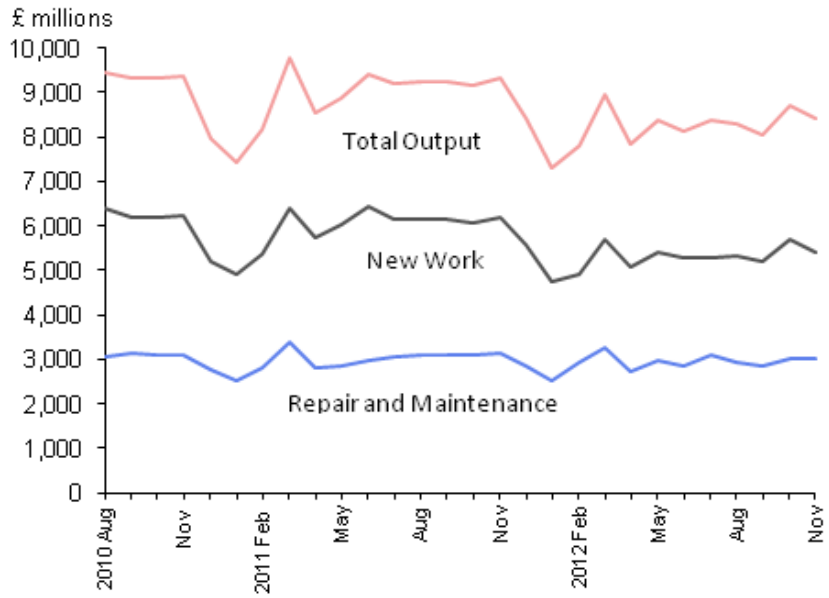

Figure 1. Current breakdown of UK construction between new build and maintenance. Source: ONS, 2010.

So it is not clear that the UK is a '*developed*' country from a construction perspective: we are still building things, and are still developing at the expense of our countryside. This is the same in other '*developed'* countries. Moll S, Bringezu, Schutz (2005) note that we have expanded the urban area of Europe by around 20% in the last 20 years: far more than the 6% growth in the population over this time. This continued process of '*development*' therefore occurs just as much in the UK as in rapidly developing and urbanising countries such as China and Bangladesh. This results in our natural environment being valued primarily in resource terms which are transformed into physical capital assets, which require more land. This is focused on expanding transport infrastructure and urban areas, both of which are

intrinsically linked to the process of continued globalisation. Development increases the total *scale* of our resource use per person, partly as a result of the increasing *separation* of increasingly urban consumers from producers in rural and industrial areas, spanning global supply chains. In Germany the net additions to capital stock are ten tonnes per person each year, and still *increasing* year on year – which represents a further 450 km^2 of built environment each year – or 15 m^2 built on every second.

Therefore it is not clear that a distinction between developing and developed economies is helpful in the context of considering what sustainable, post-growth construction and industry might entail. Instead, we need to move towards sustainability, both in the UK and globally.

3. How does Capital Investment impact upon how much we consume in the UK?

It is well known that as the aircraft industry increases the number of routes and flights and this creates pressure for greater runway capacity, which then is marketed to further increase the demand for air travel. A similar relationship exists between ship size, dredged depth of container ports and the scale of global shipping trade. Less explored is the relationship between the number of households and how this links to the dynamics and scale of the market in different household consumer goods.

3.1 TVs: energy efficiency is not enough – the more we buy the more energy we use

New construction has a significant impact upon the scale of consumer goods in the UK. This is illustrated by considering how the market for TVs relates to the housing market. Changes in our ownership and use of TVs show that increased energy efficiency does not naturally lead to a reduction in energy use. Not surprisingly, research shows a massive increase in the number of TVs per household in recent years. For example, the number of TVs per household increased from 0.91 to 1.7 between 1970 and 1994 (Boardman, et al, 1995).

However, the total impact of TVs is increased even further by two factors: more households and bigger TVs. Firstly, the total number of households in the UK is rising faster than our increasing population as fewer people live in each home. The average UK household has shrunk from 2.9 to 2.3 people over the past 40 years, which is partly responsible for the 41% increase in the number of UK households over this period (DCLG, 2012), leading to the largest number of bedrooms per person in the UK, ever (Monbiot, 2011).

This increase has not just increased demand for new homes but also for a wide range of consumer goods from cars and carpets to fridges and furniture. This is also reflected in overall trends in household energy use, which have partially offset efforts to decarbonise electricity supply in the UK. Even though the energy use *per* household fell by 3.3% from 1990 to 2007, the total energy use increased by 10%. This was due to more houses and a 3.5% increase in energy expenditure per capita over this period.

While house construction has helped push up the number of TVs, technology has also accelerated their rate of disposal and size. Meanwhile, digital transmission and the move to TVs that are HD-Ready have pushed demand for larger TVs. Larger TVs have led to increased energy consumption by TVs, even when the energy use for a given model has improved. The average size TV purchased in 2007 had a 46 inch screen and used 400 watts of power (Source: Which Magazine).

To address this we must shift from celebrating TVs' improving energy efficiency to considering absolute energy use. For example, Calwell (2010) analyses trends of TV energy use across the EU and US and demonstrates that overall energy use is going up, even with higher standards of energy efficiency per square inch. Therefore, it is not increasing viewing hours that increases TV energy use, but the rate at which we move to super-size TVs and increase the number of

them, thus also driving up the energy we consume in the production of the TVs themselves.

3.2 How do consumption trends affect the scale of industrial production?

Our household purchases, from fridges and freezers to laptops and cookers, don't last as long as they used to. This so-called planned obsolescence has been well documented with various analyses of the disposability of our consumer goods over the past twenty years. For example, Cooper (2004) surveyed consumer attitudes to products and found that only 29% of cookers and 43% of fridges and freezers were beyond repair when they were disposed of – with 48% and 37% respectively still in working order. ERM's Longer Life Products research (Downes et al, 2011) estimated that the average life of the UK's 3.5 million printers and 28.5 million toasters is just 3 and 5.5 years respectively. Similarly, the Parliamentary Office of Science and Technology reported over six years ago (POST, 2007) that the average life of the UK's mobile phones was less than two years.

Yet only 8% of the half a million tonnes of household waste electrical and electronic equipment (WEEE) thrown away in the UK each year is reused, representing a loss of £106 million for repairing and reselling items from Household Waste and Recycling Centres alone (LGA, 2013). Clearly this is unsustainable in terms of resource use. In the preface to Longer Lasting Products (Downes et al, 2011), Cooper notes that there is still little progress on extending product life – or even on collecting data on product longevity since his earlier report for NEF (Cooper, 1994). ERM's research noted above concludes that there are no policies currently in place that aim to extend the lifetime of products as their primary objective, in spite of various calls for a better approach.

3.3 Fridges: An example of how Capital Investment and Consumption Increase Together

Changing consumption patterns have increased food waste in the UK. Studies show that food waste in the average British home increased from 1–3% before the Second World War to around 5-6% by 1976 and 25% in 2008-2009 (Parfiff, Barthel and Macnaughton, 2010).Their research suggests that the current amount of household food waste is in itself only around 65% of total food waste: the rest occuring during food manufacturing, distribution and retail.

Garnett explains how this has occurred, not only in spite of increased refrigeration, but also because of it, as we buy more perishable foods (Garnett, 2010). Out-of-season fresh produce, sourced globally, and increased purchases of ready meals entail increases in food transport in ways that have driven up refrigerated and cold storage in the supply chain. For example, AEA Technology (2005) noted an increase of 27% in urban car food km, 1% increase in HGV movements and 140% increase in air freight leading to a 12% increase in CO2 emissions of food freight in the UK from 1992 to 2002. This in turn has increased refrigeration in retail stores, which now accounts for around half of all retail energy use(Garnett, 2007). This change in consumption patterns has also increased the number

and size of fridges in our homes. For example, Calwell (2010) notes that across the EU the total number of refrigerators in use has risen by 50% and their average size has grown by 30% since 1975. As a result, overall refrigeration accounts for around 1.2% of UK's CO_2 emissions (Garnett, 2007). These changes have also led to more construction: of more power stations to increase energy supply, expanding national and global food distribution systems, larger food stores, as well as infrastructure to deal with the increased food waste this system generates.

So in our consumer society we throw away everything - from food to buildings, although the latter are larger and thrown away less quickly, as highlighted above. Our economy cannot become sustainable while we continue expanding the scale of our infrastructure (e.g. building more airports or roads) and built environment (e.g. housing and town centre redevelopments) or focus on the leading edge technical innovations chosen to drive economic growth today. These all expand the scale and throughput of consumer goods as well as further increasing the resources needed to sustain (maintain) a larger built environment.

3.4 Conclusion

Capital investment is related to the continued expansion in the scale of production and consumption of consumer goods in developed economies. This is reflected in both an increase in the number of consumer goods per household as well an increasing number of households overall.

The next section explores further why this means an alternative approach to capital investment as well as industrial production is needed if we are to limit the expansion of both the *scale* of our built environment and consumer goods, which is necessary to create sustainable economy.

4. How does Capital Investment relate to our Current Economy?

Considering how construction and consumption growth are related is complex, and perhaps for this reason has been the subject of much less detailed analysis. This is also a nested problem, as we have seen, operating at different levels. Wilhelmsson and Wigren (2011) found that public infrastructure investments cause residential construction in the long run, and also vice versa.

4.1 Our Developed Consumer Economy is Unsustainable

The role of capital investment in new built environment or productive capacity (often termed intermediate production) is not considered in standard economic models. Neither is the way intermediate investment leads to further expansion of both capital investment and levels of consumption, whether measured in terms of energy supply and demand, material throughput or pounds sterling. This makes our current economy *increasingly* unsustainable. The basic model of this defective 'developed (consumer) economy' is set out in Figure 2.

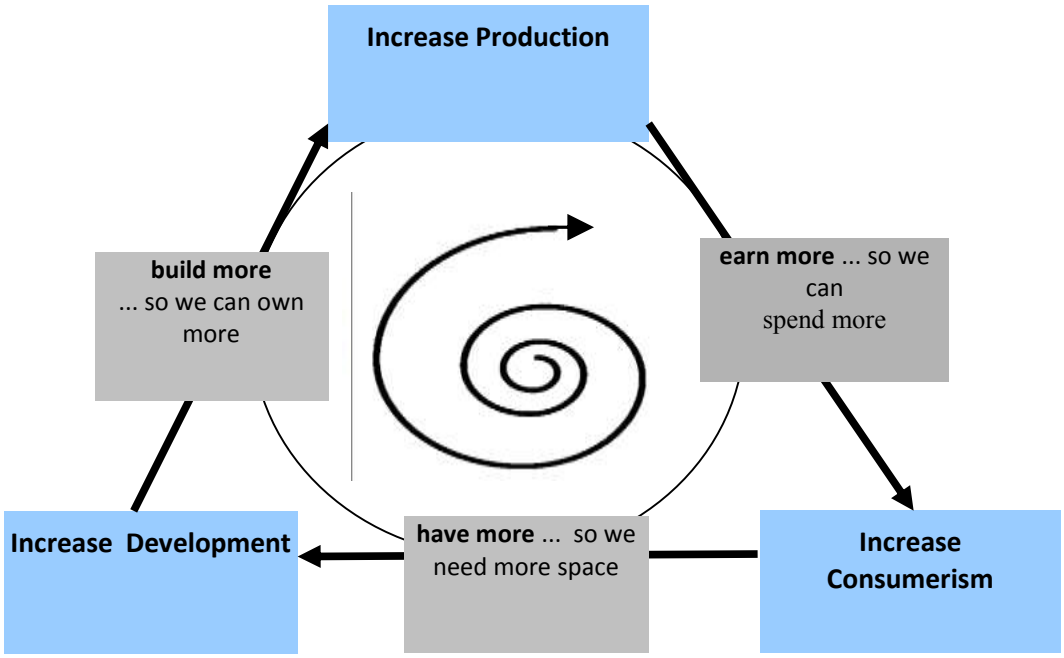

Figure 2: Model of a Typical Developed Consumer Economy. Source: Author

Figure 2 suggests that there is not just one engine of growth in the consumer-capitalist economy but *two*: consumerism *and* capital investment (also referred to as development, and generally comprised of construction and investment in new industrial production capacity).

This also suggests considering together whether the expansion of our built environment is constitutes 'sustainable development' alongside the relationship between production and consumption of goods and services. These do not act independently of each other. Instead, they tend to work together in a way that continues to increase the level of resource and energy consumption in our economy, which is reported as economic growth. They both act as economic multipliers within the economy, compounding growth by simultaneously increasing the space for consumption as well as generating increased demand for consumer products. This often starts with *speculative investment* that *'predicts and provides'* new built environment, including infrastructure and factories. Investment in new construction as well as marketing new products work together like two interlinked cogs – acting together to continue to increase both the scale and throughput our current unsustainable way of life. This process leads to ever more of our natural environment being developed and capitalised within our economy, as presented in Figure 3.

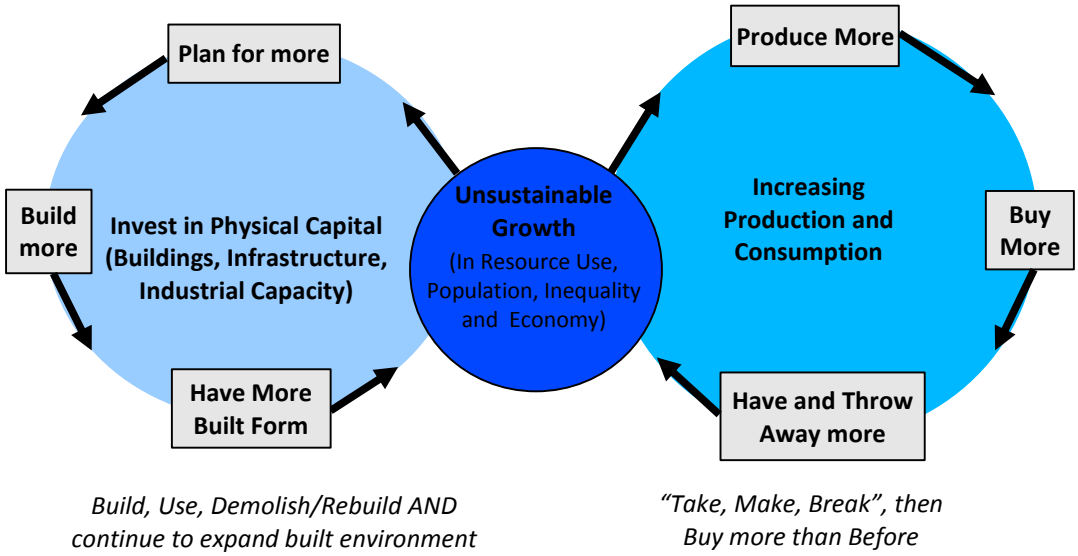

Figure 3 – Capital Investment and Consumption: The Twin Engines of Current Economic Growth. Source: Author

This figure illustrates how unsustainable growth links to both continued investment in physical capital and increased consumer spending. Increased productive capacity leads to more goods being produced for both consumer consumption and intermediate investment in more physical capital such as factories, buildings and infrastructure. Similarly, consumption is increased by both higher product obsolescence as well as by increasing the total amount of goods in circulation – which is boosted by an enlarged built environment. Taken together, this illustrates why expanding physical capital (which is predominantly

reflected in the scale of our built environment) tends to require further resources and energy, both for its own construction and maintenance and for the increased scale of consumer goods which require resource and energy inputs for their production, use and disposal.

This report challenges the current mainstream notions of 'developed' and 'developing' economies, which are not just misleading but actually incorrect once sustainability is considered. This can only really be understood in the context of the continued expansion of consumerism and the scale of our built environment: distinguishing between whether a country is still *developing* a consumer economy, or has already *developed* a consumer economy. *In this context,* the challenge of sustaining our *developed consumer economy* in the UK is generally described in terms of avoiding cycles of boom and bust; but what is not questioned is how this consumer economy is structured such that it **continues to grow both in its physical size and in its throughput of consumer goods**, year by year, as measured in terms of economic growth and in terms of our trade flows.

This current approach is unsustainable in two ways. Firstly, we are encouraged to consume stuff (physical resources) at a faster and faster rate, with technology perhaps the most effective way of generating obsolescence, alongside fashion and disposability. Secondly, the expansion of the scale of our buildings, production facilities and infrastructure (both in the UK, and globally) helps to ratchet up and then lock us into ever higher levels of consumption (see Figure 3 above).

The first relationship, between economic growth and *consumption* is evidenced by many, such as by Jackson (2009), who sets out in detail how an alternative, prosperity without growth, is possible. This has also been explored in economic terms elsewhere in Green House's Post Growth project and by Victor (2009), Scott Cato (2012) and Dietz and O'Neil (2013).

However, it is the addition of the second aspect which turns this into a greater challenge. Instead of questioning the extent to which the current economy must change to enable sustainable living, we also need to consider how this links to production and construction. This requires us to also focus on the nature and role of capital investment in determining whether an economy is sustainable or not.

4.2 How Does Capital Investment relate to Unsustainable Economic Growth?

Investment in capital assets accounts for around 20% of GDP globally, and 25% of that is construction and investment in asset-heavy industries including transport, utilities and telecoms, oil and gas, chemical and automotive, and high tech new industries (See Lewis, 2009 and Steiners, 2011). Steiners found a 69% correlation between economic growth and investment in the top 30 most significant economies.

However, the total impact of capital investment, even that of the construction industry alone, is not well documented. Crosthwaite (2000) notes how the construction industry has rarely been defined as an overall sector including the impact of its vast global supply chain, from mining to manufacturing. Instead it is normally represented in national income accounts as the value added directly on a construction site itself, so includes only direct labour, plant and overhead costs. This in some part explains why there is a dearth of detailed analysis of the overall carbon emissions of the construction industry: as both facilities management and DIY (ongoing maintenance and refurbishment) and supply of construction materials and fit-out products are generally accounted for separately.

Lewis (2009) has analysed this and concludes that the actual size of the construction industry is around twice that normally measured by national statistics, as this does not capture maintenance works or the full extent of the supply chain of construction products, and accounts for around 3-5% of GDP in developing economies, increasing to 5-9% in industrialised countries, and thereafter remains a key part of the gross capital fixed assets (GCFA) of developed countries, converging to around 23% of GDP for developed countries. This means that the *creation of new fixed capital items (which for a large part is construction) accounts for around a quarter of GDP in developed countries, and construction alone around a tenth of GDP*.

This supports the idea that the economies of developed countries combine ongoing growth not just of the scale of consumption but continued expansion of the physical scale of the economy that is required to accommodate this – as suggested in Figures 2 and 3 above. This is supported by Chang and Neih (2004) and Wilhelmsson and Wigren (2011), whose research in Taiwan and Europe found that construction stimulates economic growth, but not the other way around. Similarly, Lopes (2009) concluded that once countries have developed (constructed) then continued economic growth and development can be sustained. This view is reflected in research linking investment in physical infrastructure and the current model of unsustainable economic growth in the UK. For example, Oxford Economics (NHF, 2010) found that investment in housing has a fiscal multiplier of 1.4, which means that for every £1 spent on house-building, £1.40 will be generated across the economy as a whole. Meanwhile, a UK Contractors Group funded study (CEBR, 2010) calculated a fiscal multiplier of 2.84 for the construction sector in general (LEK, 2009) and a much higher multiplier for school construction (3.87 - 5.04) including the indirect benefits delivered.

4.3 How are Fossil Fuel Extraction, Capital Investment and GDP Related?

In May 2012 the oil and gas sector and supply of material resources represented 72% of the turnover and 40% of the market capitalisation of the London Stock Exchange (2012). Meanwhile the scale of coal mining is both massive and increasing. For example, the IEA's 2008 Energy Economic Outlook predicts coal increasing from 25% to 28% of energy consumed by 2030, contributing to a 57% rise in CO2 emissions from 2005 levels. The industrial sector and the retail and service sectors were both much smaller, but still significant with 20% and 15% market capitalisation respectively. So, production industries rather than retailing and service industries dominate the UK stock market. Globally, fossil fuel represents around 5%, and total capital investment around 23% of World GDP.

It is also fundamental to stress that these levels of production of fossil fuels are not just far too high to be sustainable, but are still increasing. This is due to both continued increase in overall energy demand, and a shift in production to more expensive (e.g. deep sea) and unconventional energy sources (e.g. shale, tar sands and coal-bed methane) which are far more expensive to extract (both in energy and financial terms) than conventional fossil fuels, so will increase the demand for fossil fuel extraction, even if consumer demand remains the same. McKibben (2012) highlights that for a reasonable chance of remaining within 2°C global warming we have to avoid emitting no more than *one fifth* of all already proven reserves of oil, gas and coal listed by companies and countries. Divestment of these dangerous-to-use assets, as well as similar 'reserves' that place a value on unsustainable levels of exploitation of natural environment (such as rainforests and mining) requires an asset write-off similar to the way a debt jubilee is needed to periodically write off unsustainable debt (Scott Cato, this project). Similarly, the abolition of over £1trillion fossil fuel subsidies globally is needed, and a moratorium on the construction of new fossil fuel power stations. (See Clark, 2012 and Barnham, Knorr and Mazzer, 2012).

This requires not just a shift in consumer behaviour but a change in production. This is because the economy is not just a simple supply-demand system but instead consists of primary industries, secondary (manufacturing, including for construction) and tertiary (service) elements, which operate sequentially. Materials and energy flow from resource extraction, to be used to create products and develop real estate, before consumers and services use these. And the intermediate elements (construction and industrial production) can have many stages. For example, the manufacture of construction products and machinery is required to build and fit out a factory before it can manufacture goods. Because of these different stages, although energy extraction is only a small part of the economy, subsequent industrial activities amplify this to a far larger role that both drives and defines the nature of our economy (see Figure 4).

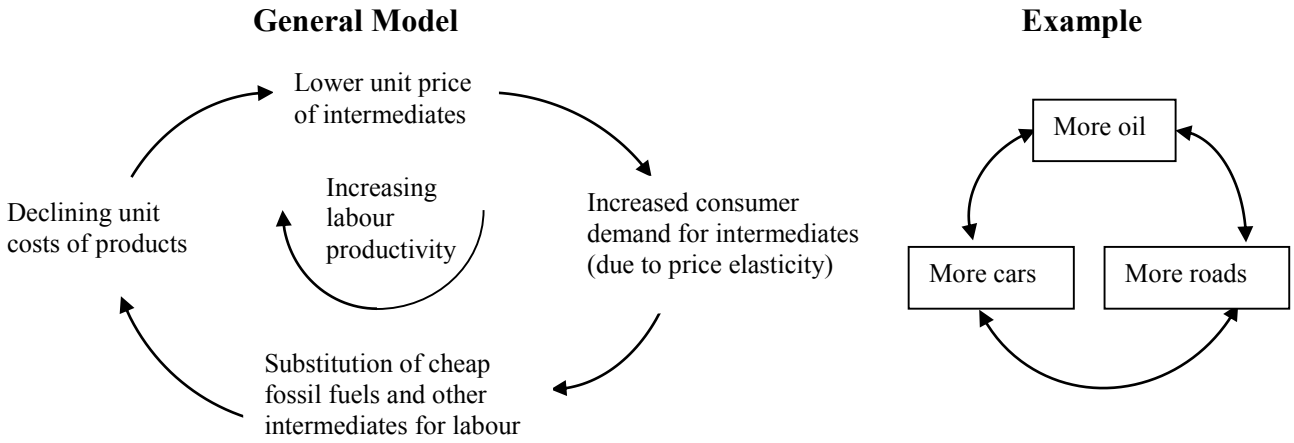

Figure 4: The Fossil Fuel Growth Engine**.** Source: adapted from Ayres, 2001

However, we cannot replace all of our current fossil fuel supply in the UK with renewable energy generation. The Centre for Alternative Technology (2007) estimated that replacing only 50% of energy supply was possible, just considering resources produced and consumed within the UK. Similarly, WWF (2008) calculated that the throughput of renewable resources in the UK should be reduced to one-third of its present level for us to be sustainable – from 'three-planet living' to One Planet Living. This suggests that we need to not just reduce our fossil fuel use to zero, but reduce the scale of our industrial production by around two-thirds in the UK.

5. Review of Current Approaches to Green the UK Economy

This section explores whether current approaches to greening industry and construction can lead to sustainability before considering what an approach focused on transforming the overall nature of *production* to shift to a socially and environmentally sustainable economy in the UK might entail. The emissions of consumption are not considered as to some extent these follow from production, and also because this is covered extensively by others. Current approaches to the industry (as opposed to the specific renewable energy generation sector), construction and waste sectors are considered in the sub-sections below.

5.1 Resource Efficiency and the Circular Economy

Mainstream analysis tends to consider the impact upon economic growth of resource constraints (as opposed to the impact of avoiding climate change). This tends towards a strategy of increasing resource efficiency, whether of energy or material inputs. Such a scaling up of production tends to drive up throughput, and is reflected as an increase in economic growth overall. Thus increased energy efficiency can cause this so-called 'rebound effect', limiting the potential for decoupling energy consumption from economic growth (Sorrell, 2010). For example, McKinsey's review of how best to respond to growing demand for resources globally (Dobbs et al, 2011, p61) concludes that:

> *If investment in supply remained at historical levels and productivity growth improved ... [then] the annual pace for supply additions over the next 20 years would have to be almost triple the rate at which it expanded over the past two decades.*

However, when considering this challenge alongside action to mitigate climate change, Dobbs et al (2011, p70) conclude that this is *almost impossible*, suggesting instead that governments choose a combination of '*expanding supply*' and '*boosting resource productivity*' rather than respond to the climate challenge as illustrated in Figure 5. This is because the climate response scenario is estimated to require an require an additional $260 billion to $370 billion capital expenditure globally each year, largely for the generation of power using renewable energy. This means advocating a strategy to continue on the current development path and build resilience to *resource constraints* rather than acting in ways that will mitigate or adapt to the effects of *climate change*.

	Supply expansion	Productivity response	Climate response
Return on investment (£, not energy)		30% opportunities < 10%	Requires public subsidy
Agency issues in decision-making		Some issues	
Information for investment	Reserves remaining unclear	Low awareness of opportunities	
Supply-chain needed for implementation	Risk	New skills needed	Lacks full value chain
Capital available (perception of financial institutions)	Familiar	Less familiar	Higher risk
Technology required	Some new technologies	Existing technologies	Some unproven technologies
Culture change needed	No change	Requires change in behaviour/ mind-set	

Figure 5: Contrasting Economic Strategies to address Resource Scarcity. Source: Adapted from Dobbs et al, 2011, p119.

As Heatley (2012) notes, the McKinsey analysis only covers the next twenty years, discounts climate change, pollution, reduction in bio-diversity or degradation of eco-system services, double counts input productivity improvements and doesn't take proper account of rebound effects from resource or energy efficiency gains.

This approach is reflected further in McKinsey's work underpinning the Ellen MacArthur Foundation's championing of the circular economy (McKinsey, 2012). This proposal to focus on systemic changes within a circular economy is welcome, such as the need to educate and redesign as well as looking at wider issues to address the persistent issue of obsolescence. Similarly admirable is the Royal Society of Arts' (RSA) new proposal for a Great Recovery, (RSA, 2013) which highlights the potential to redesign products that are destined to become residual waste. Better design should, in theory, enable products to have a longer life and be recycled and recovered.

The overall aim of the circular economy is to reduce carbon emissions per tonne of resource processed, but it is not sufficiently local or people-centred to address climate change. However, the current focus on creating better consumer goods as highlighted by the RSA (2013) and improving resource efficiency as promoted by the Ellen MacArthur Foundation (based on work by McKinsey, 2012) does not address the issue of the increased scale of our consumption or the extent of recycling that is possible when products made from different materials are mixed or joined together. However, the extent to which it is implemented might instead reflect industry concerns, such as the potential to recover rare

earth metals more cheaply from waste rather than from the dwindling and hard to access global reserves as noted by McKinsey (Dobbs et al, 2011). Douthwaite (2012) goes further, and suggests that it is this limit of global resources that led to the economic crisis from 2007, so the current response, limited to focusing on how to best retain the current throughput of consumer goods is at best only a short-term fix, and is not sustainable.

Without addressing this, the transition is not so much from a 'take, make, break' linear economy to a circular one but closely corresponds to the spiral driven by the twin engines of economic growth described in Figures 2 and 3. Also, the focus on solutions driven by industry, rather than overall sustainability, means that the element of reuse is often missing from current measures.

Such an analysis is reflected in a general disconnect between mainstream economics and consideration of climate change impacts, which at best reduces concern to climate adaptation, independent of climate change mitigation; an approach that will be catastrophic in the shorter term for climate vulnerable economies such as Bangladesh and unsustainable globally in the medium to long term for the UK. However, this is still the current mainstream approach. For example, the recent World Bank's Commission on Growth and Development chose not to consider climate change at all, and was only interested in developing a strong *investment* climate. Similarly, McKinsey's report on the impact of China's aggregate city growth to 1 billion urban residents (Woetzel et al, 2009) makes no mention or consideration of either climate adaptation or even climate change in its consideration of resource and economic growth impacts. For climate change a different direction for economic development is required. For example, Anderson and Bows (2012) show this would require a complete change in proposed economic development planned for shipping, which is predicted to double or treble emissions compared to 2010 levels by 2050, while emissions must reduce by 85% by 2050 to be consistent with an even chance of avoiding over 2°C global warming.

5.2 Sustainable Construction: Looking Beyond Low Carbon New Housing

The current focus on sustainable development in the UK appears to be on building sustainable communities with zero carbon homes; i.e. for a small part of the construction industry – while the rest of the sector is, at least in part, heading in the wrong direction.

There are some best practice examples. BioRegional and Bill Dunster Architects designed and delivered the Beddington Zero Energy Development (BedZED) which aimed to enable zero carbon and zero waste living (BioRegional, 2009). This concept is being replicated in other so-called One Planet Living Communities (Desai, 2009) and carbon neutral (in-use) homes (www.zerobillshome.com/zerobillshome/). This approach has reduced the direct carbon emissions of the residents' household energy and transport use, including through building design with thicker insulation and the establishment of London's first car club.

However, in the last few years the forthcoming zero carbon (*in-use*) standard for houses has been watered down, and developers have successfully lobbied to enable both these environmental standards and also affordable housing targets to be omitted if *they* can't afford them – as reflected in the new 'affordability test' in the National Planning Policy Framework which has led to environmental standards falling while there has been a strong return to profitability within the UK house building industry (Ellis, 2014, pp7-9).

But even the UK government's 'zero carbon homes' standard only considers carbon emissions once the occupants move into a new house. This completely ignores the carbon emissions and much of the wider environmental impact associated with house construction, as well as the resource and climate impact of making all the things that we buy to turn a house into a home.

This omission is a significant one. In the UK half of our carbon emissions relate to how we live while the other half are made up by what we build and buy. (This is based on DECC: 2010 together with estimate of imports from Sorrell, 2010; similar figures for London reported in the Capital Consumption report by BioRegional (2009). Industry energy and electricity use (21%), business (12%), freight transport (4%), agriculture (7%), waste (2%) and imports (19%)).

At least 10% of this total is related to the construction of our built environment while the rest is the impact of making and disposing of what we consume. (See Morrell (2010) estimates that this element of the construction alone represents 10% of the UK's carbon emissions. This estimate does not include repair and maintenance, which is noted in Figure 1 as around one third of the UK total. This suggests a total impact of 'construction and maintenance of the built environment' of around 15%, as reported in Capital Consumption (BioRegional, 2009) for London.

Yet the UK's construction industry currently has no mandatory target or action plan to reduce its own carbon emissions.

5.3 Rethinking the Globalised Waste Industry

Another example of the limits to current approaches is in the approach to waste. Best practice approaching zero-waste exists at the household and community level. For example, in 2013 Cwm Harry's new collection service for the community of Presteign reduced their non-recyclable waste to close by 80% in just over two years. Similarly, BedZED residents achieving twice the local council's average of 30% recycling in 2007. Other examples of community best practice include the Rubbish Diet (see myzerowaste.com) and Zero Waste Communities (see www.zerowasteeurope.eu).

BioRegional aimed to help address this issue by working with the local council to agree an action plan to deliver a One Planet Borough of Sutton. However, this has not changed financial incentives locally, let alone the structure of the industry nationally or globally. So, just like other councils, Sutton has partnered with a waste provider, who has responded to government incentives, and together they have successfully secured planning permission to build an incinerator which will commit Sutton,

which declared a wish to become zero carbon, to increase emissions of carbon for at least 25 years. [This will mean producing power that far exceeds even the conservative (compared to climate science targets, as noted by Anderson (2012), referred to above) target of 50gCO2/kWh for all electricity generation by 2030 proposed by the government's Committee on Climate Change (See www.theccc.org.uk/sectors/power) - based on meeting a target of carbon emission reductions within the UK of 80% by 2050, which itself falls far short of the latest climate science.)

This is unnecessary as total household waste levels (just like car use as illustrated in Figure 10 below) have already peaked in the UK and are now falling, year on year. So instead of building new waste disposal plants we should be shifting waste further up the waste hierarchy, from recycling to waste reuse and reduction instead. This is vital as we cannot shift from three to one planet living in terms of resource use in the UK, let alone zero carbon emissions, by recycling alone.

For example, around 40% of household glass recycling nationally is now *'downcycled'* to be used as sand in road construction (See ENDS, 2013), and as proper glass recycling still only recovers one third of the energy compared to making new glass, the current overall carbon saving for glass recycling is just 20% in the UK. The equivalent statistics for plastics and paper are to recover 50% of embedded energy at best. These figures don't include the carbon emissions of shipping recycling vast distances to be reprocessed: Tetrapacks to Scandinavia, and much recyclate to China and the Far East. So, instead of focusing first on recycling food, paper, metal and other items and accepting that incinerators will increasingly burn the mixed plastic residue that remains, we need national policy changes to achieve zero waste, a policy led by waste reduction and reuse (requiring different behaviour and regulations) rather than focusing on technology first. So, the current mainstream approach, while promising better recycling with its combination of clever recycling sorting plants and more efficient incinerators, can only ever paint the illusion of One Planet Living.

A zero waste approach which is within environmental limits will mean a desire to avoid waste and reuse more - which will not just reduce carbon emissions (and potentially decrease primary resource extraction) but also reduce the loss of the workmanship embodied in products that are used only for a short time before being thrown away. Applying a *reuse-led* approach could extend from consumer products to our whole built environment.

We can focus on *upusing* (extending the life of items, possibly through sharing or repurposing) rather than *downcycling* (recycling to make it again from the basic materials). The notion of *upusing* an item, whether a set of tools or perhaps a building, is to propose that reuse need not be viewed as a 'hand-me-down' or as 'second-hand'. Instead reuse can be seen as shared value, increasing utilisation and therefore not just retaining but adding value, enabling us to better make do, with less. A recent example of this is Berlin's "borrowing shop" established in 2012 and billed as a 'library of things'. This has already inspired other borrowing bar and a cafe with a 'cupboard for things' in other parts of Berlin and other borrowing shops elsewhere.

Meanwhile, there has been a recent tendency to downgrade what we mean by words like recycling and sustainability in the UK. Recycling now often is understood to mean collection-for-recycling, rather than delving into how much of the material collected is actually remanufactured back into the same quality product again. As well as sustainable sourcing such as for timber, we need sustainable destinations. We *can* remove from our the culture the notion that it is acceptable to simply throw stuff away, that somehow recovery of energy-from-waste, or scrapping and disposing of products after the end of an often very short life is good enough.

An alternative could be to focus on shared value to increase attention on repair and reuse as opposed to new production. And this does not just apply to consumer products. For example, public transport tends to last longer. For example, the length of time to keep a car in the US reached an all-time high of 11 years in 2013 while London Underground stock lasts for 40 years on average.

This is consistent with the principles of global equality, local productivity and shared ownership as set out by Dobson (2014), as a politics for post-growth.

5.4 Conclusion: Greener but not Sustainable Enough

Clearly, purchasing newer 'greener' products and building greener houses and infrastructure might ameliorate some of the additional environmental impact of these products to some degree compared to no change. However, as shown above, the overall impact of introducing even the highest sustainability standards for *new* products still generally *adds* to our overall ecological and carbon footprint, rather than helping reduce the impact of our current way of life. Anderson (2012, p17) sums it up clearly:

> *There is certainly plenty of discussion of mitigation, but seldom does it focus on the actual gap between the claims we make as individuals, companies, nations and a global community and what is actually happening in terms of absolute emissions. Buying a slightly more efficient car or improving the performance of supermarket refrigerators has nothing to do with solutions to climate change if we subsequently drive further or chill more of our food.*

Unless it is downsizing (e.g. replacing a car with a bicycle), additional purchases tend to increase the total amount of products in circulation (each containing embodied carbon) as well as the total level of direct emissions – in electricity, heat and transport – as we tend to use more products, travelling further, in a bigger and warmer built environment.

This is clear with respect to expansion of transport in the UK. While most transport development calculates its benefits in terms of travel time saved, the total time travelled has risen slightly in the UK from 1970 to 2005 (Metz, 2008), during which period car ownership has more than doubled and average distance travelled per person increased by 60%. Allen and Brown (2010) show that although the average haulage length in the UK has fallen, this is set alongside the highest ever total tonne-km travelled (160 billion tonne km in 2007) and increasing

volume of imports as manufacturing has shifted overseas.

The same trends are apparent in the impact of mainstreaming energy efficiency measures into UK homes. This has led to the average temperature in the average room in the average house in the UK has increased 7ºC since 1971. This increase in comfort has massively reduced the impact of improved insulation on reducing home energy use.

Similarly, as our overall energy use continues to rise, renewable energy generation is supplementing rather than replacing existing fossil fuel power generation. IEA (2013) predicts that renewables will account for around 40% of additional energy supply by 2035 globally, rather than displace existing fossil fuel sources, meaning that the energy sector, which is responsible for 2/3 of global greenhouse gas emissions, continues to increase in size. This continued growth means that peak 'conventional' oil is likely to lead to pressure for more fossil fuel to be supplied from unconventional processes such as hydraulic fracturing and oil shale. As these use more energy in production for each unit of energy supplied to consumers, this will lead to CO2 emissions from production to increase, even if the amount of fossil fuel supplied to consumers reaches a plateau or falls as renewable supplement existing energy supplies.

Overall, this increase in our scale of production completely overshadows all current efforts at greening industry – so our global and UK economy both remain stubbornly unsustainable.

Therefore, an entirely new approach to capital investment and industry is required for us to move to a post-growth society, both in the UK and as part of our global industrial economy.

Part 2: A Make Do and Mend and Approach: A Sustainable *Enough* Transition?

The second part of this report proposes an alternative model of development and a strategy for economic sustainability that:

- starts with the Objectives of the UK Sustainable Development Strategy: to deliver a high quality of life for *all,* within sustainable levels of energy and resource use;
- reflects the scale of the climate and resource challenge globally;
- proposes limiting capital investment to that with a positive Energy Return on Energy Invested, in line with climate targets;
- therefore, shifts investment to focus on solutions that combine people and technology, creating employment and local sustainability; and
- is reflected in proactive decision-making, which involves decision makers at all levels, both in the UK, and in other countries worldwide.

6. One Planet Investment: A Framework for Prioritising Sustainability

6.1 Revisiting the UK Sustainable Development Strategy

An alternative approach to prioritising economic growth is to prioritise social and environmental sustainability. This is already set out in the Securing the Future, the UK's Sustainable Development Strategy (Defra, 2005) as is indicated in Figure 6 below. Its two overarching objectives are to deliver 'quality of life for all' and for this to be 'within environmental limits'. The strategy places 'good governance', 'sound science' and 'achieving a sustainable economy' as supporting aims, to help achieve these objectives. However, even though this is enshrined in the UK government policy (Defra, 2005), and includes a framework which could support a post-growth investment strategy, it is not reflected in the reality of UK politics or economics. Neither does that reality adopt the compromise notion of a triple-bottom line, the idea that it is possible to prioritise social, environmental and economic sustainability together.

Instead a single, quantified measure of financial success, whether GDP nationally or the return on financial investment for businesses or developers respectively, still dominates. The political reality is that the three supporting aims mentioned above are dominated by the political power that prioritises economic growth and technological progress above all else. The UK's sustainability objectives of social and environmental sustainability need to be treated not as partial constraints on economic growth, but ends in themselves. This is summarised in Figure 6:

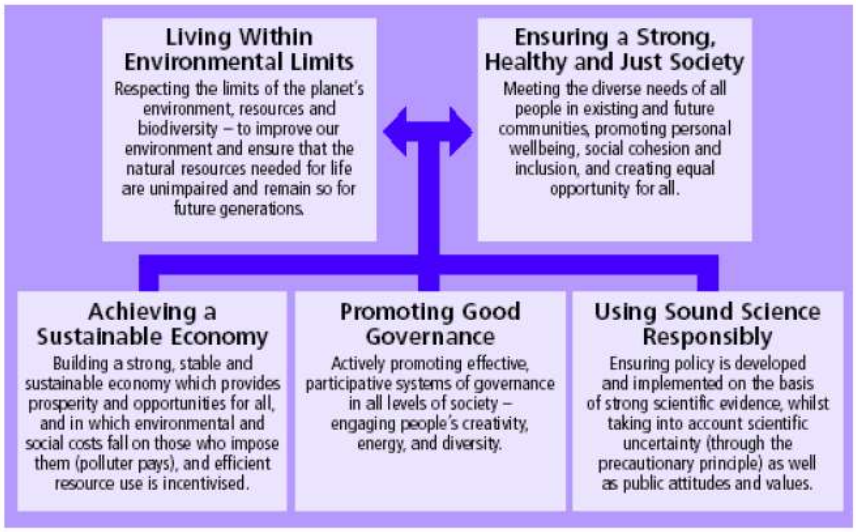

Figure 6. UK Sustainable Development Strategy's Twin Social and Environmental Objectives. Source: Defra, 2005, p16

This figure shows that what is needed is not just the existing level of legislation, charitable and personal lifestyle choices, or green consumer products – but a shift in the mainstream that is sufficient for the quality of life *for all* to be sustainable.

6.2 Limits to Sustainability with Current Financial Incentives

A real change is required in how we prioritise what we produce and invest in both in the UK, and globally. Currently investment is prioritised based on the level of *financial return* and risk. So investment responds to fiscal incentives (e.g. incinerators through long-term government financed agreements, or roads following government cost benefit analysis) or more speculative motives (e.g. real estate development, including housing and shopping centres). Either way this approach focuses on investment in physical capital. Therefore, it tends to expand the overall scale of the UK's built environment and globalised productive supply chain, which both increase the scale of direct energy use and the throughput of consumer goods. And although investment opportunities sometimes align with social and environmental sustainability, even best practice is rarely sustainable enough.

The difficulty of achieving this by acting alone at a local level is highlighted considering the example of residents of BedZED (also mentioned in Section 4.2 above). A survey of residents seven years after the development was completed found that resident's ecological and carbon footprint had reduced to an average of 2.6 planets and 10 tonnes CO_2/year. But these are still relatively high numbers. The reason that BedZED's target of 'One Planet Living' has not been achieved is partially due to the rebound effect: some of the savings through lower-carbon living onsite have been offset elsewhere by residents at BedZED flying more each year than the national average (BioRegional, 2009).

It is also because there are few visible changes beyond the boundaries of the site itself. To address these two aspects requires actions at different levels; from the local council to national policy and global finance, as proposed by Francis and Wheeler (2006). For example, even if safe and desirable walking and cycle routes are available, their use will depend on seemingly unrelated factors such as the location and distance of the average commute to work.

A similar example is a not-for-profit reuse centre – which might achieve some diversion of waste to reuse, but is unlikely to affect the financial decision on whether or not to build a new incineration plant. While best practice examples can set new benchmarks for business-as-usual, which might be mainstreamed, they are rarely likely to be environmentally sustainable *enough* on their own. Like transition towns, these could be described as 'transitional projects': containing elements of what sustainable living might be like, where financial incentives allow. This is summarised in Figure 7:

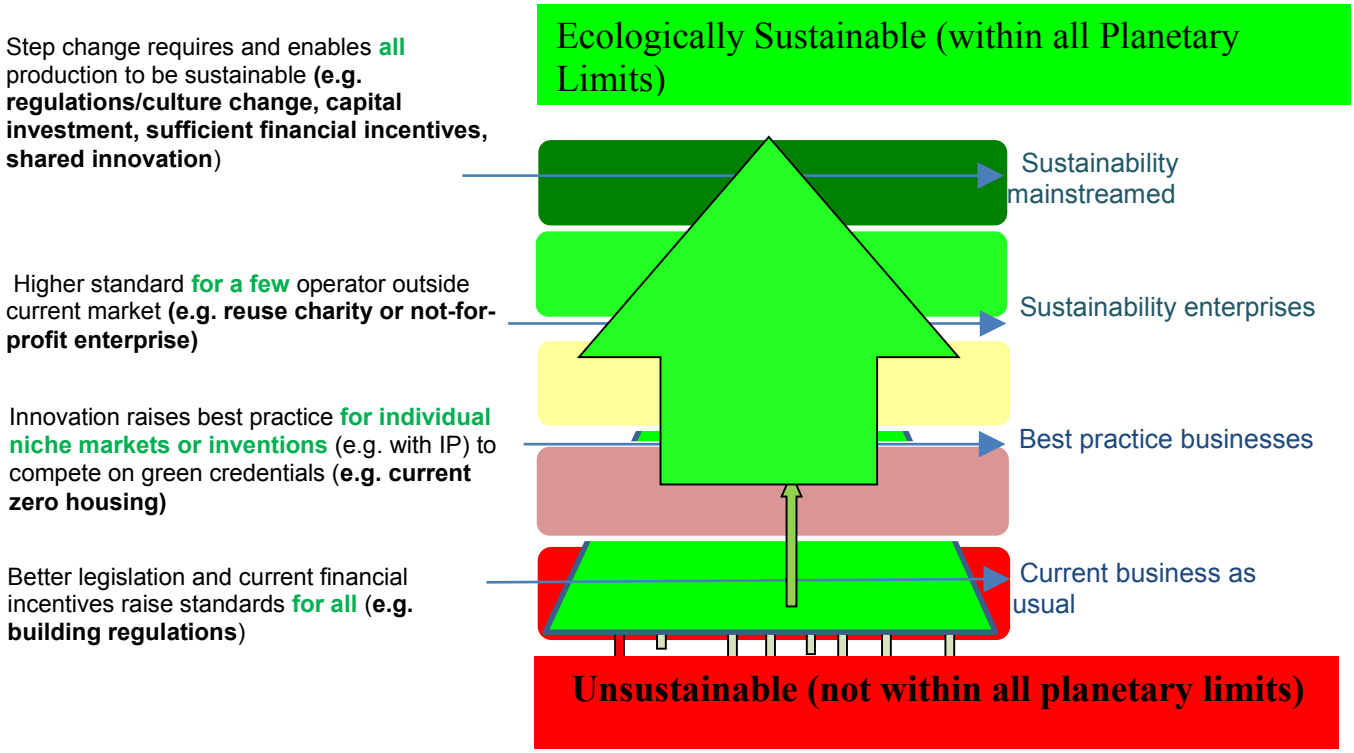

Figure 7. Relating Sustainability with Business-as-Usual. Source: Author

6.3 One Planet Investment: Bridging the Gap between Mainstream Solutions and Sustainability

So while sustainability best practice case studies exist like Transition's REconomy and BedZED projects (Hopkins, 2008; Rowell, 2010; and BioRegional, 2009), the question is: how can these be mainstreamed, whilst ensuring all real examples are *sustainable enough*?

This requires a different approach to the current linear 'incentivise-invest-build' relationship between government policy and industrial strategy. Instead of trying to justify seeking the least worst (still unsustainable) option, such as a shift from landfill to incineration, disposal to recycling, coal-fired to gas-fired power stations, we need to shift to doing things that are sustainable *enough*.

This means giving up on a much used phrase: 'sustainable' development. This is generally meant to improve what is currently proposed – not to make it good enough. Some of those embedded in mainstream businesses might challenge this by saying that being committed to a *sufficiently* sustainable future is unrealistic: that the *perfect is the enemy of the good*. But as long as mainstream business continues to indulge in its self-interest for continued expansion in its turnover or profitability then the mirage of 'green growth' is all we have. Our whole approach to industry and construction represents a globally connected example of the Tragedy of the Commons (Hardin, 1968). We are still accelerating the rate of depletion of resources and acceleration of climate pollution globally as each part of our economy aims to maximise its own self-interest and the scale of the built environment and production continue to increase, unconstrained.

Unless this is challenged in its entirety then we will not, collectively, be able to deliver sustainability – even while individual projects aspire to be sustainable enough.

An example of this approach is in the work of Julian Allwood's team at Cambridge University who have analysed how a four-fold reduction in industrial climate impact globally (Allwood and Cullen, 2011) might be achieved. Their report, *With Both Eyes Open*, concluded that this requires policy changes to redirect our whole economy, rather than looking at a 'greener industry' and 'greener consumers' as separate challenges. And this rethinking of industry needs to consider all the emissions, including those embedded in international trade – which are huge. Figure 7 shows how the UK has only achieved a reduction in its carbon emissions through shifting industrial production for UK consumption overseas.

This increasing net import of carbon emissions (embedded in products) is reflected in the UK's trade balance. There have only been six years in the last century, the last in 1982, when the UK has had a surplus trade in goods (ONS, 2012, p36). For this to be addressed while reducing the carbon and resource footprint across all parts of the UK economy as noted above, more of our needs have to be met through production locally and regionally across the UK, reducing the need for imports.

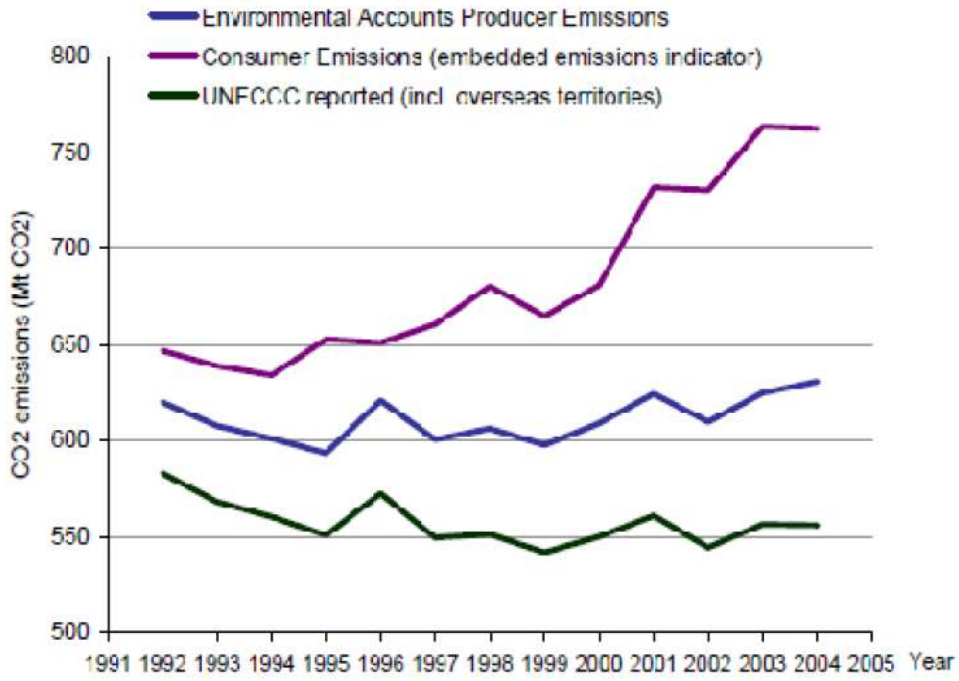

Figure 8: UK CO2 emissions according to different accounting principles. Source: Wiedmann et al, 2010.

This requires a shift from our current globalised industrial strategy and continued physical development to a jobs-intensive *'industrious enterprise'*

strategy. This will not be reflected in single technical innovations (there is no techno-fix to continued sea level rise, for example) but myriad forms of creativity and entrepreneurship, such as increased maintenance and refurbishment, retrofit and repurposing, reclamation and remanufacture, repair and reuse, redesigning and reworking, retailoring and retail. (Interestingly, the original word for retail is of French origin, first meaning to cut off, clip, pare or divide, and was later used to refer to sale of small quantities of items, presumably including re-tailoring of clothing.)

These will focus first on addressing the root cause of the problem (expansion in the scale of our impact on the environment) rather than on ameliorating the impact of one activity or one aspect alone. For example, building additional zero carbon new homes without considering the embodied carbon in construction materials leads to an increase in carbon emissions, even if these have no net carbon emissions in use. Similarly, recycling that requires (more) global transportation or waste recovery that increases carbon emissions is not sustainable. For example, we must invest first in reducing our society's *scale of production* and consumption to a sustainable level of energy and *stuff* – or our attempts to tackle climate change will amount to little more than King Canute building a few more sea defences.

An alternative framework must replace such a Canute-style mentality. The 'One Planet Hierarchy' presented in Figure 8 highlights the gap between current practice and sustainability in different areas from energy and waste to transport. It could be extended further to consider how different processes of engagement (e.g. require, consult, participate, empower) might be located on this framework. However, the main focus is simply to use the idea of 'One Planet Living' to highlight the kind of decision making that is required to bring about a sustainable future.

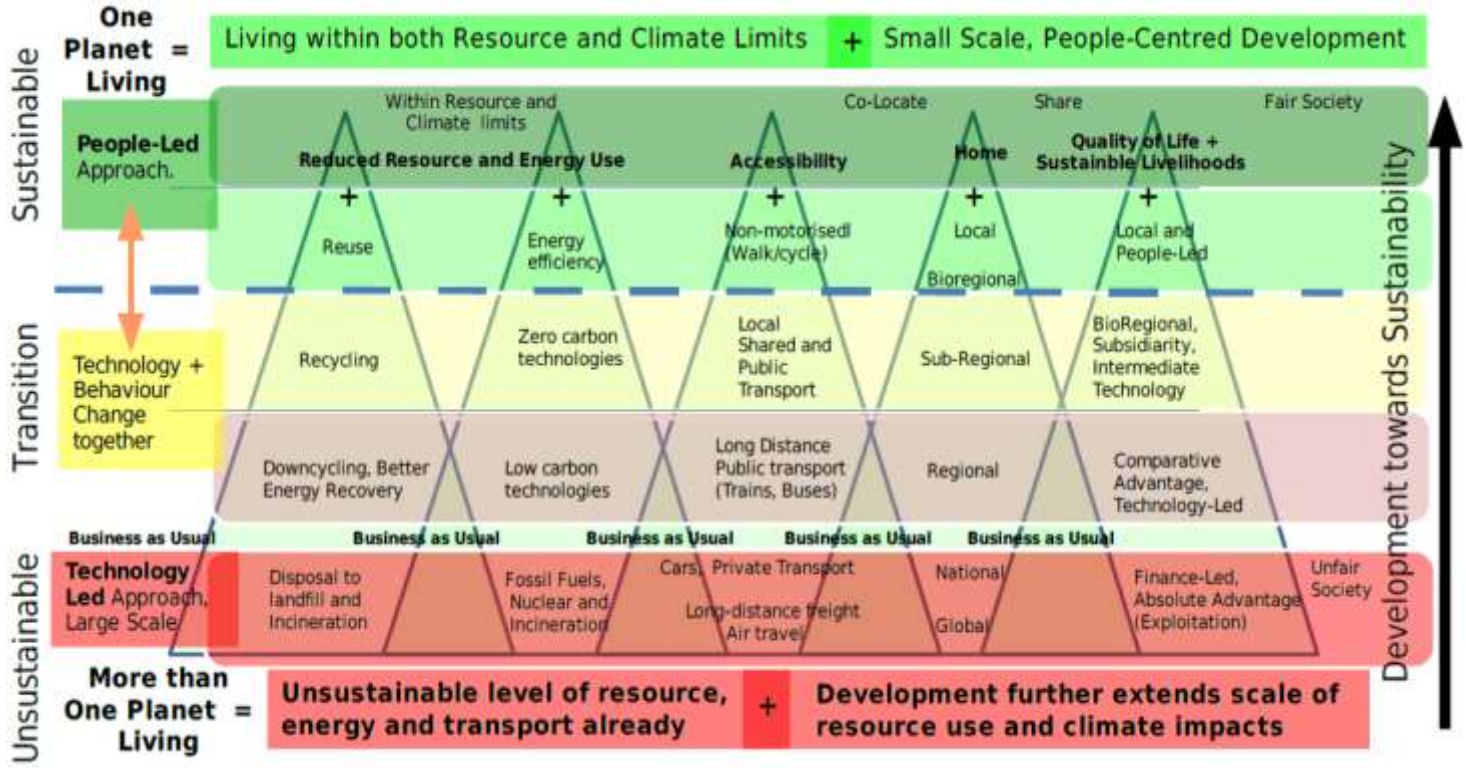

Figure 9. One Planet Hierarchy for a Sustainable Economy. Source: Author

Figure 9 considers the main areas where there are currently perverse incentives against environmental sustainability in the UK: energy use and carbon emissions, resource use and waste, transport and mobility, and the scale of development. There are various reasons for this – which could be summarised as economics and political decision making that puts short-term self-interest first. Examples include:

- continued expansion of the scale of our physical environment increases its overall scale, so any net project impacts represent additional gross planetary impacts;

- business-as-usual financial incentives drive most projects – so the starting point for most private sector funded projects is not sustainability but the business-as-usual line (see over) which is where profitability can be maximised (Bakan, 2004). Laissez-faire economics drives the market to respond as low down on this One Planet Hierarchy as possible (see above). The only constraint on this is the enforcement and strengthening of government regulations or incentives, which is the focus of environmental campaigners the world over;

- improvements are also constrained by strong **perverse economic incentives and existing investment** which limit the extent to which most private sector projects can afford to be sustainable without changing substantially the return on investment, ownership models and ownership of decision making;

- increasing the scale of the built environment and population mean that as business-as-usual best practice improves, overall consumption continues to rise. This means that sustainable solutions have only been found wholly successful in addressing local (specific) environmental concerns, as global **targets for what is sustainable enough are also pushed up**. This is generally described as relative rather than absolute decoupling (see Jackson, 2009);

As a result of the above, **sustainable-enough projects tend to be restricted** to those attracting public or philanthropic funding sufficient to offset the perverse economic incentives against sustainability. This limits their replication and reach. It can also mean that best practice is only the focus on those aspects receiving highest public scrutiny. [For example, the reuse rate of timber for construction sites is around one tenth of that for household furniture in part because the former must compete with an incentive to incinerate reusable timber whereas the latter receives some UK public funding.] The extent to which such sustainable-enough projects are allowed to be public sector funded is limited by EU competition law, so unless the rules that govern the economy are changed, sustainable solutions will be out-competed by unsustainable mainstream practice in most sectors of the economy.

Together this is summarised as resulting in one of two alternative outcomes of progress – whether in terms of investment in physical capital or in industrial production capacity: One Planet Living or More than One Planet Living

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7. A Clear Strategy that reflects the Scale of the Global Resource and Climate Challenges.

Infrastructure investment could be planned and incentivised to deliver both a positive Energy Return On Energy Invested (EROEI) and a *truly sustainable* circular economy. Together these could result in a locally resilient economy, where transport is minimised, and sharing of resources and participation are maximised. Such an approach means considering the comparative environmental and social advantages before the comparative economic advantage of different decisions. This is vital if the natural tendency for material and energy to be degraded in the economy is to be limited as far as practicable (Georgescu-Roegen, 1971). Without mainstreaming this approach of first considering the social and environmental limits on what is acceptable investment, then whatever the ecological and community aspiration, the tendency will be for the economy to rebound to a linear 'take-make-break' one, rather than a *truly sustainable*, circular economy.

7.1 Rethinking Transport and Spatial Planning: Prioritising Local over Global

Perhaps the greatest challenge for the transition to sustainability is the continued increase in the scale of transport. This is linked to globalisation, as well as to national policy. However, the continued increase in transport is not responding to unsustainable demand – but creating it. For example, in the UK the government is accelerating road building plans, while the UK has already peaked in its car-use (see Figure 10). This trend is mirrored in many other countries worldwide (Newman, Kenworthy and Glazebrook, 2013).

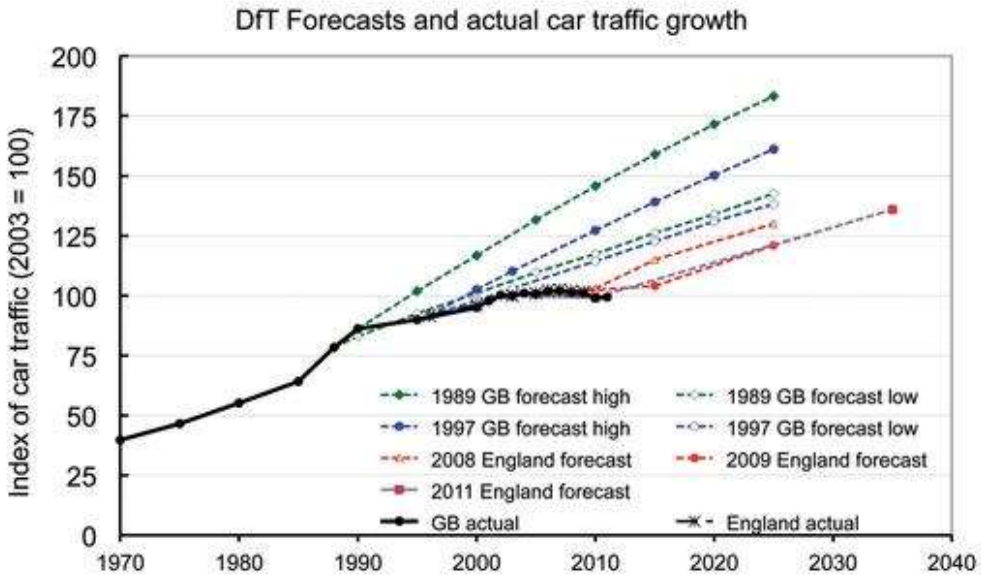


Figure 10: Growth Projection against Post-Growth Reality: UK car use has peaked. Source: Goodwin (2012)**.**

In contrast to the UK government's policy - that is, continuing unsustainable expansion of its road transport network - other countries have a more progressive transport policy. For example, Bogota in Columbia has been developed in a way that sustains public transport and non-motorised transport by adopting strategies that integrate behaviour change, technology (fuel efficiency) and land-use planning (as concluded by Wright, 2004). This approach is reflected in the Bogota Declaration (FTS, 2011) and represents a transitional approach as noted in Figure 10 above, with technology and behaviour change combining to inform a plan-led approach. This alternative approach to development is reflected in the visionary statements by Bogota's former Mayor Enrique Penalosa who claimed that, "a developed country is not a place where the poor have cars; it's where the rich use public transport".

Sustainable re-localisation and public transport can reduce transport, which supports a re-prioritisation from building more (particularly road and airport) infrastructure to better maintaining what we have already got. Local employment to prevent potholes trumps road widening and bypass schemes. But this is a win-win solution. Local sourcing, maintenance and production will create local employment, particularly in food, energy and construction/building products.

For example, Riddlestone and Desai (2002) proposed that Ricardo's concept of comparative advantage should be revised to take into account the environmental impact of long-distance transport. They proposed a FEET (foreign exchange earnings per transport tonne of CO2) index. Riddlestone and Desai used the example of air-freighted strawberries as an example where local production has a high merit. Similarly, heavy materials such as construction products should be locally sourced, as these also have a significant transport carbon impact.

This can add to quality of life by creating local distinctiveness and seasonal variations in cuisine, lead to buildings having a different character as the local materials vary (e.g. Cotswold Stone, Aberdeen Granite) and create different industries reflecting availability of different materials in each locality.

Also, reducing long-distance transport of heavy goods will cut the carbon and cost expended for ongoing maintenance and repairs, enabling the local economic strategy to focus further on improving employment rather than extending spending on infrastructure. In the same way as waste reduction reduces the need for waste disposal capacity, transport reduction reduces the need not just for road capacity but road maintenance. Heavy goods vehicles drive maintenance costs in particular, as road damage is proportional to $(\text{axle load})^4$. For example, one HGV will cause the same road damage as 150,000 car movements. This is one example of a new approach to development.

Not building new infrastructure also avoids locking-in high levels of resource and energy use for years to come. This is important as such decisions with longer life times (such as construction of buildings and transport infrastructure – see Figure 10) lock us into unsustainable increases in carbon emissions for many years to come, while reducing the flexibility to adapt to climate change.

The alternative - limiting *physical* investment to that with a positive energy return on energy invested (EROEI) *and* sufficiently flexible to adapt to climate change - is proposed below. This is a huge contrast to current urban development, which is increasingly airport-led (Freestone, 2009).

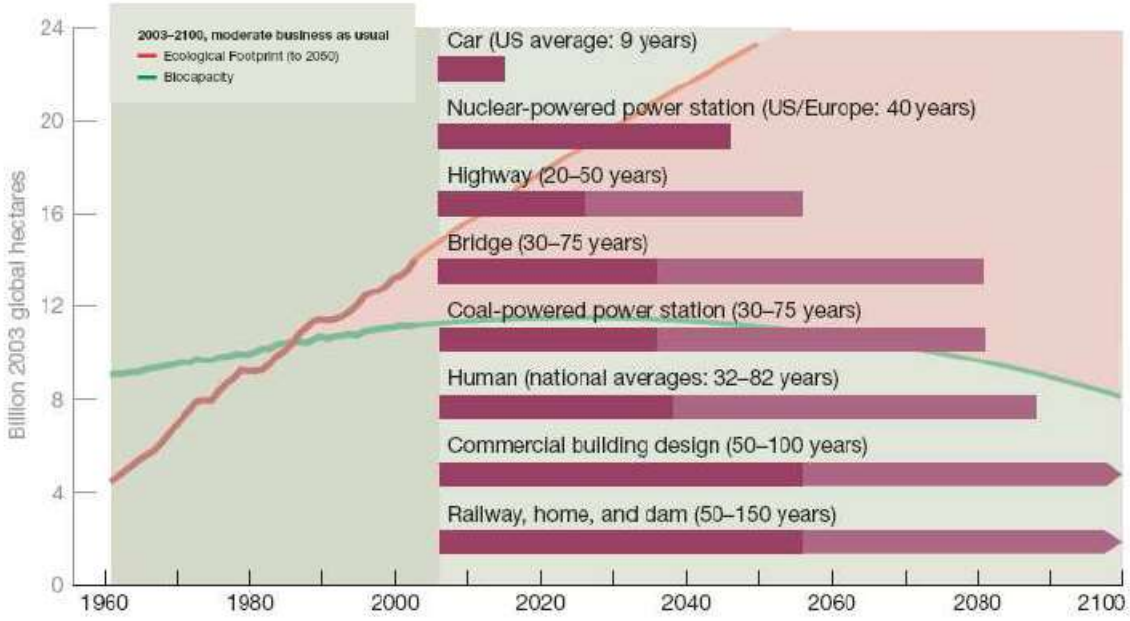


Figure 11 Lifespans of People, Assets and Infrastructure. Source: WWF Living Planet Report, 2006:p 26

7.2 From Driving Growth to Enabling Transition

The UK's current economic strategy could be summarised in two words: 'build more'. It aims to kick-start the existing (unsustainable) economy through a combination of state-funded building and relaxation of planning laws and the 'help to buy' scheme to support a private sector housing boom. This has created a partial recovery, with the benefits skewed to the richest 1%, focused on the already wealthiest part of the country (London and the South East) while underemployment and unemployment persist and inequality between the property-owning and working classes has increased markedly. And from an environmental perspective the UK Chancellor George Osborne's basic economic strategy outlined above is disastrous. It is an instance of a basic strategy that reflects how most resource-hungry *developed country* economies appear to work. By increasing the supply of new houses (as well as shops, utilities and transport infrastructure), the aim is to stimulate the purchase of new homes and thus the formation of new households to generate demand for more consumer goods, including cars. This has been partly due to population growth, but also due to a reduction in the persons per household in the UK from 2.9 to 2.3 in the past 40 years, increasing the total amount of built environment and consumer goods per capita in the process.

This simple notion is reflected in the IMF and government fiscal multipliers which suggest that investment in more buildings and infrastructure tends to lead to even more spending, travel and energy use by consumers.

This focus on development means that construction and industries that manufacture construction materials are viewed as key sectors in the economy as they lead to the *creation of new fixed capital items, which accounts for around a quarter of GDP in developed countries.* Such a continued increase in the scale of our built environment and consumer goods throughput is reflected in our increased demand for materials and energy: both to make these things and to use them. And the extent to which this dominates our economy is almost unbelievable. Unless this is challenged through a new industrial strategy, then renewable energy and energy efficiency will only ever be part of the energy mix, ameliorating the rate of increase in energy demand and carbon emissions of an expanding consumer economy.

The scale of the challenge for a sustainable transition from this current fossil fuel based economy could be compared to the creation of the peace-time economy in Britain in 1945. At that time the objective of full employment was secured not just through Welfare State investment in health, education and social security, but through the parallel support for investment in new industry via the creation of the Industrial and Commercial Finance Corporation (which was created to address the Macmillan gap, which was the failure of banks to lend, particularly to small and medium sized enterprises).

This joining-up of social and economic objectives contrasts with the UK government's new Green Investment Bank (GIB), which was established in November 2012 and which is supposed to act as the centre-piece for the UK's new industrial strategy, The GIB has similar aims to the ICFC in terms of addressing a lack of bank lending, and directs this towards building carbon emitting incinerators, as well as loans for energy efficiency and renewable energy projects that help the UK to meet its EU commitment to secure 20% of renewable energy capacity by 2020 (EC, 2009). But in contrast to 1945, when the establishment of a Welfare State included a commitment to achieve full employment, the GIB sits alongside job losses due to public sector cuts, and has no targets for job creation itself. Yet in terms of scale it remains small. The GIB aims to secure around a billion pounds of investment each year, which pales into insignificance in comparison to the trillion Euros of investment envisaged for Germany's green energy revolution, which is not just focused on renewable energy but subsidises a Green New Deal style retrofit of existing buildings across the country.

The TUC propose a much wider approach than the establishment of the GIB or even Germany's current *Energiewende* programme. Their Industrial Strategy for the UK (TUC, 2011) propose that the government actively intervene with a proactive strategy to reverse the ongoing loss of (largely manufacturing) jobs across the UK's regions, including the creation of a further 50,000 jobs in the UK's growing remanufacturing sector. This builds upon their Just Transition Report (TUC, 2008) which proposed active investment in green enterprises, like the 249,000 new renewable energy jobs in Germany, as employment in the energy intensive sectors declines - anticipated losses across the EU are

estimated to be as much as 50,000 and 8,000 in steel and concrete production respectively. Such an approach reflects a reduction in capital investment in physical assets, supporting the shift away from the current construction-centred model of development as noted above. The same arguments are made by Compass (Cox, 2012).

However, a sustainable transition cannot be delivered by these measures acting alongside continued business-as-usual production and development. At least two things are required to cut our addiction to fossil fuels. Firstly, there must be an overall reduction in capital intensive investment, including in fossil fuel and resource extraction. Instead, investment should be planned where there is a positive *Energy Return On Energy Invested* (EROEI) – i.e. there should be net reduction in energy use in use, which quickly pays back the up-front embodied energy in manufacture and construction. Examples of this are renewable energy investment and a mass home insulation scheme mentioned above. But this should apply not just to these programmes, but to all economic investment. This should include both climate adaption and mitigation measures. For example, it would mean that climate mitigation is prioritised and considered for all adaptation measures, such as flooding (e.g. design-for-deconstruction, early warning systems, sustainable urban drainage, reduced building on green field sites upstream and floodplains).

Secondly, this must lead to a downshift in consumption that increases wellbeing, rather than support for expansion of economic growth. Existing industry and construction need to make better use of the built environment and resources we already use. It means not just slowing, but halting or even reversing both the continued expansion of our total amount of built environment, as well as the sheer scale and the rate at which we buy and then dispose of consumer goods. This is needed to ensure that there is no rebound effect (for example, constructing extra wind turbines and zero carbon homes will increase consumption unless they displace existing capacity). This means that the transition to sustainability must extend beyond scaling-up current best practice, such as community farms, renewable energy co-operatives and green micro-businesses. The transition must also occur at an industrial scale through a conversion programme that shifts production away from energy-intensive consumption and towards the products that will facilitate a resilient future. One key to this will be divesting from fossil fuels.

This transition from investing in new capital, to re-investing in what we already have, within resource constraints, is huge. It is also a cultural shift from an economy of 'more' and 'better' to one of 'enough' as proposed by Dietz and O'Neill (2013). This requires a new, slimmed down *physical* investment strategy.

7.3 People-Centred Investment: Why a Focus on Jobs is vital to creating a Sustainable Economy

Apart from cases where there is a clear, positive 'Energy Return On Energy Invested' (EROEI), as noted above, most new investment must be of an entirely different type if it is to be sustainable. This means that investment in infrastructure should not just be different (e.g. shift of resources from transport infrastructure expansion noted above to climate change adaptation measures) but less,

refocusing on employment (using the existing built environment) instead.

However, the focus currently is on making existing industries 'greener' or 'more resource efficient', rather than sustainable enough (both different enough and smaller enough) to address the challenge of climate change.

To be sustainable enough, a circular physical economy (in terms of both resource and energy use) requires a different structure for the *financial economy*. Currently, sustainability issues are often treated as technical design aspects. Sustainability is integrated in the design of a specific development rather than into the overall system. This leads to that development often occurring at the cheapest location and at scale so it is therefore likely to a) still develop global, regional or national scale facilities, so still require materials to be transported huge distances and/or b) focus on technology which is material or energy intensive.

For an economy to be sustainable everywhere there needs to be a comparative advantage of reuse-repair-remanufacture (extending the life, that is, the sustain-ability of existing products) over the current take-make-dispose dominant process of resource use. This means ensuring the theory of comparative advantage is first applied in terms of sustainability advantage (e.g. reduce, reuse and recycle in that order before recovery or disposal of resources; or carbon reduction before energy efficiency and zero carbon renewable before low-carbon generation capacity). This means the most sustainable type and scale of production is chosen, before considering where it is to be located.

However, the current industrial economy is predicated on cheap mechanised production that is not always designed-for-deconstruction, or globalised production, when goods are manufactured where wages (and also, in some cases, materials and energy) are cheapest. For example, consider the ease of repair of a toaster, a chair or a pair of socks, produced with labour valued at £1/day overseas. The scale of the repair sector (in the for-profit, business economy) is much lower in the UK than Bangladesh, because the official minimum wage is over thirty times higher. As a result the sustainable circular economy often only exists outside of the financial economy, with the toaster repaired at a Restart cafe, chair repaired through DIY skills or reused through a local not-for-profit Furniture Reuse Charity, and the socks darned at home.

As is highlighted with the examples of toasters, chairs and socks above, the most sustainable options might be more local, smaller-scale and more labour intensive that the technology-led, larger-scale (and less sustainable) alternatives which are currently incentivised to have a better financial return on investment. For example, reusing bottles rather than recycling bottles into new glass cullet or downcycling into construction sand is likely to require more local employment (e.g. a milkman, delivering from a local farm), and currently costs more. An alternative approach is therefore likely to consider the qualitative links between environmental sustainability and employment.

Much of EF Schumacher's Small is Beautiful (1973) focuses on the nature of employment. One central tenet, the notion of intermediate technology, led Schumacher to found the development

charity now known as Practical Action. He proposed that it was far better to invest capital in technologies that lead to a large number of semi-skilled jobs than to invest the same capital in higher-tech industries that create fewer jobs but more physical infrastructure. Similarly, EU (2005) research shows that shifting incentives from capital investment in energy-to-waste infrastructure to local (less capital intensive) reuse and recycling jobs creates at least *ten times as many jobs* per tonne of waste processed. It also increases the overall carbon savings as both the embodied energy and product and material value of waste are reclaimed. In other sectors, Elliot (2013) cites research by the University of Utah in 2009 which compared the jobs created by better use of roads (public transport), road repair and road construction and found the former created an extra 31% and 16% of jobs respectively for each $ invested. The same is likely to be true for retrofit of empty houses, rather than new build housing construction, as reflected in the Green New Deal above.

Such an investment approach (to create decent work) would also help improve equality both across the UK geographically and across the income distribution of the UK population. The current focus on economic growth has led to rising inequality both in the UK (where the share of wages as a percentage of total income has fallen from a peak of around 64% to around 54% in 2011) and has failed as a strategy to address inequality elsewhere (Woodward and Simms, 2006). Woodward and Simms (2006) concluded a focus on global growth in the 1990s led to a growth in inequality both between and within countries: for every $1 of poverty reduction achieved, $166 of additional global production and consumption was created. They propose policies designed explicitly and directly to achieve social and environmental objectives ... treating growth as a by-product.

7.4 Accelerating the Transition by Incentivising Ecological Enterprises

Therefore, rapidly achieving the conversion of our industry to become sustainable, while reversing current trends in increasing inequality in the UK, will need a much more radical approach than the current 'greening industry' approaches. This needs more than an entrepreneurial spirit: it needs incentives. One approach could combine spatial planning and fiscal support for new enterprises. For example, the UK's local enterprise partnerships and EU structural funds could be redirected along the lines of an Ecological Enterprise Zone as proposed by Molly Scott-Cato (2013) to the House of Commons Environmental Audit Committee:

> *EEZs would be supported by government grants to become hot-houses for the innovation of green technologies and sustainable lifestyles. In return, they would be expected to achieve significant cuts in carbon emissions, resource usage, and levels of waste production. Government should enable local authorities in such areas to experiment with policy tools, such as carbon taxation and import and export duties. The aim would be for the EEZ to become a prototype of the self-reliant local economy that a green economy requires.*

Such a focus on 'intermediate technology' will facilitate a move to more local production and lower energy use. And these enterprises, by focusing on the top of the energy and resource hierarchies will also tend to create more employment. For example, EC (2005) research shows that shifting incentives to reuse and recycling rather than burning and burying waste will increase the jobs in the waste sector by at least ten times, per tonne of waste processed. Beasley and Georgeson (2014) demonstrate that a shift to 70% recycling across Europe would equate to the creation of between 634,000 and 867,000 new jobs. Doing this also increases the overall financial return and carbon savings as both the embodied energy and product and material value of material resources are reclaimed.

Another key aspect reflected in the EEZ concept is co-location. Instead of achieving an 'economy of scale' for an individual business, this aims to maximise the value of embedding the business into local networks which work together under the principles of industrial ecology (for example, one enterprise's waste becomes a neighbouring enterprise's resource). This 'ecology of sharing' means ensuring that the full social, environmental and local economic benefits and resilience are prioritised. This requires considering the full risks and indirect impacts and benefits from the outset, including that of transport – which is not reflected in current approaches that increase globalisation. Cooperatives and clusters of micro-social enterprises of this sort tend to deepen their community outcomes and replicate successful models from one community to another: proliferating rather than scaling up.

There is already a limited focus on sustainability in the criteria for EU investment in the Union’s poorer regions, but it is not currently sufficient to reverse the trend to high-tech industrial cities with countries and regions having limited economies as lower-tech and often deprived hinterlands. One exception to this is Mondragon, a cooperative and the seventh largest industrial group in Spain, which has sustained employment through the recent economic crisis.

Colin Crooks (2012) highlighted how such an approach could represent a better economic strategy for the UK. Crooks notes that in 1934, the Special Areas (Development and Improvement) Act defined 251 'depressed areas' in the UK. But by 2005 only 49 of these had achieved a lower than national average level of unemployment at any time over the 70 year period that followed. This relates to the persistent and growing issue of worklessness in the UK. In 2012, of the forty million people of working age in the UK, over nine million were economically inactive and a total of 13.3 million were either looking for a job or for more working hours.

As a response, Colin Crooks called for investment in 1000 social-enterprise zones across the UK to create 1 million new intermediate/low-technology jobs, focused in these areas of deprivation with the objective of reducing income and regional inequality rather than of economic growth. Such a focus for spatial planning and economic investment to target employment in EEZs would encourage community-based entrepreneurship and workplace innovations along the lines of the Lucas plan (Räthzel, Uzzell and Elliot, 2010), which proposed a transition from aerospace to the production of

socially useful products to avert job losses across seventeen factories as a result of UK government defence cuts in the 1970s. Combining this focus on employment with the plan for one million climate jobs (Neale, 2010) and a Green New Deal would create a transition to a sustainable economy, both socially and environmentally (Elliott et al, 2008).

Part of the effort to create this shift could be realised through increased support for innovation and entrepreneurship in small and medium sized businesses. Hilton (2001) determines that over 99% of companies in Europe are small and medium sized enterprises (SMEs) with over 65% of employment and 50% of pollution. Examples for this change of focus from nationwide support for large companies to local support for small organisations could include:

- a shift from government support for new construction to mass energy-efficient refurbishment, led locally, of existing buildings; (Note: this is currently limited by VAT relief for new housebuilding and business rates on empty commercial premises (which encourages demolition and subsequent new build).

- a shift from government support for public-private partnership (PPP) and PFI (and similar) grant and loan deals to large corporations to develop new infrastructure to a '*PPP for good*' – incentives to support community-led management of shared resources in the UK;

- a shift from a Technology Strategy Board that picks winners based on technologically driven solutions alone to a Sustainability Strategy Board, which supports the piloting and replicating of locally sustainable solutions, through many different incentives and institutional arrangements, utilising technological innovations as appropriate.

Investing in this way reprioritises the value placed in our own skills, workmanship and creativity. This will help reignite hope that a sufficiently different future is not just necessary, but possible. While entrepreneurs often create innovations with what appear to be insufficient resources, finance and time, we need eco-entrepreneurs to do this within resource limits in ways that inspire a transition to sustainability within the time horizon dictated by climate change. This requires a new industriousness facilitated by the removal of perverse incentives against sustainability, and a clear shift from centralised decision making (via the market or state) locked-in to continued throughput and investment in energy-intensive, often centralised industries. New eco-community enterprises will address the problem locally, but need to be replicated globally to have sufficient impact.

7.5 A Sustainable Enough Industrial and Investment Strategy

This section brings together the ideas introduced above into an alternative strategy: a rapid transition towards sustainability. Instead of starting by responding to market demand for new housing or consumer products, its focus is on job creation and

maintenance. It begins by incentivising better use of existing infrastructure and resources (including land) in ways that increase employment locally. This approach will create (and change existing) enterprises that increase the strength and sustainability of local communities;. This works to both increase employment and community wellbeing while reducing environmental impact and conserving the local (and by extension, global) environment. This strategy is summarised as follows:

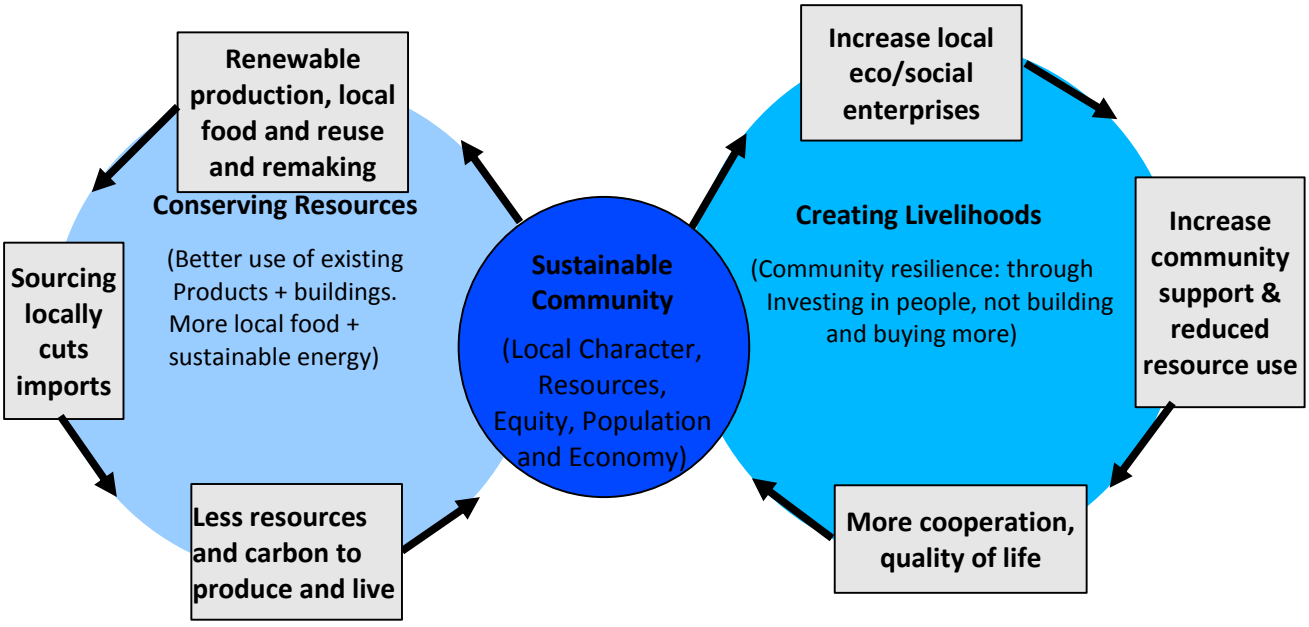
- incentivising *both* local/sub-regional resource use (instead of importing goods) and local employment, particularly semi-skilled jobs, creating new enterprises and jobs locally while delivering positive social and environmental outcomes; which

- increase self reliance in energy (renewable production, lower consumption), food and resources (reuse, repair, remanufacturing) and their retail locally; which

- push up the local economic multiplier (NEF, 2002), creating a resilient local economy; which

- reduce the scale of transport (both commuting and freight) and other infrastructure needs, focusing on smaller-scale operations locally (e.g. a smaller quarrying operation, collating reclamation and reuse enterprises); and which

- lead to the demand for housing and community facilities to follow employment, which has been targeted in areas of greatest need – so there are both fewer locations with empty homes and unemployment, and less need for urban expansion.



***RE-economy**: Retaining workmanship, resources and carbon embodied in existing products and our man-made environment inspires us to Live Well, and Reduce, Reuse and Recycle our three planet consumption into less than One Planet Living.*

Figure 12: Maintenance and Jobs: Twin Enablers of a Sustainable Local Economy**.** *Source:* Author.

This is in marked contrast to the current approach. In 2012 the UK scrapped the notion of regional spatial strategies (which tended to focus on economic growth as a driver) with no planning above the local level. In 2012, with no spatial planning above the local level in the UK, economic growth (reflected by a housing boom) has occurred in Surrey and London, while North-South inequality increases.

There was 8% expansion of the economy in Surrey (conveniently sited between the City of London and the UK's main airports, Heathrow and Gatwick). This reflects a strategy of backing existing winners and integrating the UK globally, and focuses economic growth in the areas with much lower unemployment and a stronger economy already, i.e. London and the South East. Instead what is required is a national plan to allow localism to flourish across the UK, supported by incentives for zero carbon, zero waste, value-adding employment.

Investing in a Green New Deal across the economy from agriculture and public transport investment to repair and reuse (what I call a new RE-economy), but most of all a shift from construction to energy efficient retrofit of all existing homes, would create new meaningful work across the UK. This would not only lead to a more sustainable economy as a whole: with a shift from new jobs focused in London and the South East to the creation of jobs across the UK. It would also improve recirculation, increasing the resilience of the economy at a local and sub-regional level. It is expected that these jobs will not generally be created in the public sector as we know it but could be businesses, social enterprises or state-owned enterprises.

Such a strategy would support sustainability of both urban areas and their rural hinterlands by improving the resilience of individual communities (described as Transition Towns: Hopkins, 2008) and wider bioregional economies (Scott Cato, 2012), rather than developing the UK as a capital-centric and increasingly urbanised economy. This approach also underpins the notion of 'sustainable livelihoods' which was first conceptualised as a theory of change for rural sustainability (Chambers, 1983) but later adopted by the UK government as an approach to alleviate poverty through the creation of "sustainable livelihoods", through enhancing local capacities, resilience, and wider policies and institutions.

However, Chambers summed up the limits to this approach in 1997 when he wrote, *Whose Reality Counts: Putting the First Last*: the potential for sustainable economies for local areas across the UK is dependent on ensuring that these are not seen as subservient either to global supply chains or expansion of London and other major urban economies first. For sustainability we must shift to a post-industry (at least at its current scale*)* society; but as Ha Joon Chang (2010) notes, we are not a post-industrial society in the UK, just a globalised one, as we still rely on a net import of resources from overseas (as reflected in Figure 8).

Such a focus on creating locally resilient economies must be viewed as an alternative, as opposed to an adjunct, to the main trends of urbanisation and globalisation that dominate current investment and

industrial strategies both in the UK and worldwide.

Therefore, the efforts to scale-up locally sustainable energy and food production, product re-use and built environment maintenance must go hand-in-hand with a massive reduction in scale of the industrial production capacity (including fossil fuel extraction). This must lead to an end to the continued expansion of the scale of our built environment, both in the UK and globally.

As a result it is vital that industrial planning and spatial planning are conducted together.

7.6 The Scale of the Challenge of the Transition to Sustainability

The scale of this transition must be sufficient to address the climate challenge – and that is no small thing. Anderson (2012) states that to avoid *extremely dangerous* climate change we must reach a global peak in greenhouse gas emissions no later than between 2015 and 2025, with total global energy-related emissions (i.e. excluding forests and food production) then decreasing by at least 10-20% per year, as indicated in Figure 13. This means flying, driving, heating our homes, using our appliances - basically, everything we do – must be zero carbon by then.

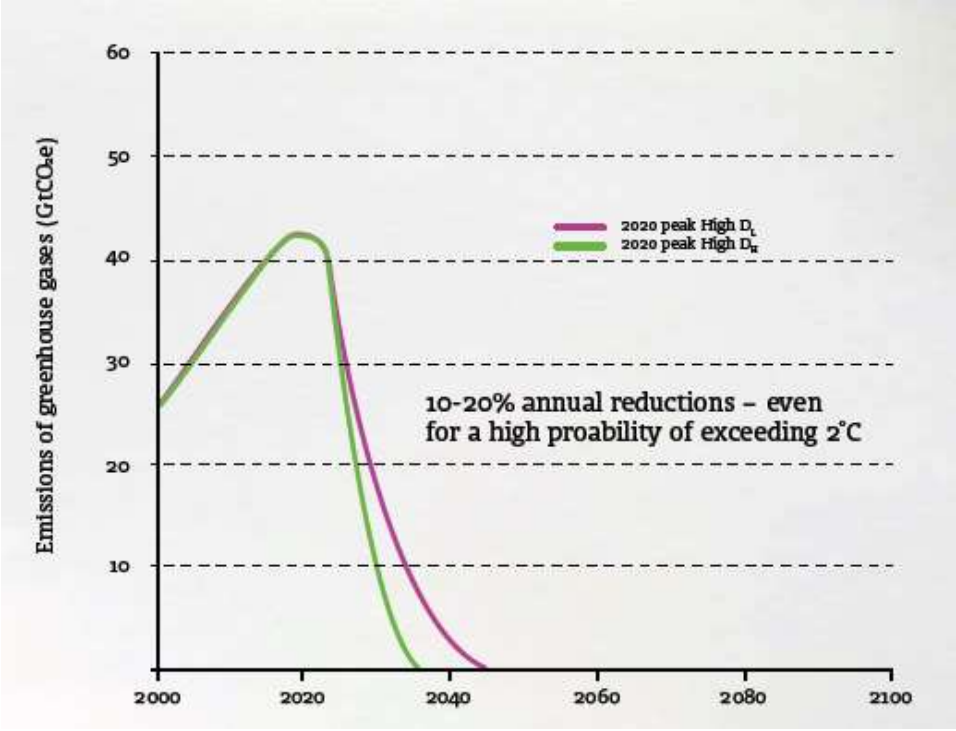


Figure 13: Global Targets for Decarbonisation to Avoid Runaway Climate Change. *Source: Anderson, 2012.*

Figure 13 illustrates that when taking unavoidable emissions from food production and deforestation emissions into consideration, global energy-related CO_2 emissions have to decrease by 10-20% per year from a peak in 2020, hitting zero between 2035 and 2045.

Yet, the rate of increase of global emissions is still rising, and is currently over 3% a year. This is consistent with the increase in global intensity of fixed capital investment as analysed by Steiner (2011). As discussed above, the problem with capital investment in construction and industrial production is that it further increases and 'locks in' future energy supply demands associated with consumption – whether this is increasing the amount of buildings to heat, transport infrastructure and vehicles to use, along with associated consumer goods from computers and refrigeration. Addressing climate change requires different (and more importantly, much less) industrial production and construction. We must do this in the UK in a way that can be replicated worldwide.

Anderson (2012, p35) concludes that the typical response to this scale of challenge is: 'That is impossible'. In response, he suggests asking *'whether living with a 4ºC global temperature rise by 2050 or 2070 is less impossible'.* To address climate change we need actions to be sufficient and mainstreamed. This requires investment and incentives to be redirected, and coordinated. To achieve this, an agreed strategy is needed for the changes in production and consumption and associated reduction and shifts in energy generation and capital investment: an *industrial strategy for sustainability.*

Figure 14 represents a possible overarching plan with two distinct strands: both reducing emissions now and simultaneously creating a new zero carbon sustainable economy for our future. Firstly, we need to decarbonise not just current consumption, but also current industry and construction which represents around a half of current UK emissions. Secondly, we must ensure new capital investment reduces both future energy "supply and demand", as set out in Figure 13. This means there is a limit on how much new 'greener' industry we can create. For new investment to reduce rather than increase consumption, in a way that is far greater than its own direct impact, it must lead to a net reduction of carbon emissions. This suggests capital investment is limited mainly to that which generates a positive energy (or carbon) return on the embodied energy (or carbon) invested (EROEI), such as investment in renewable energy or reducing the emissions of our existing built environment.

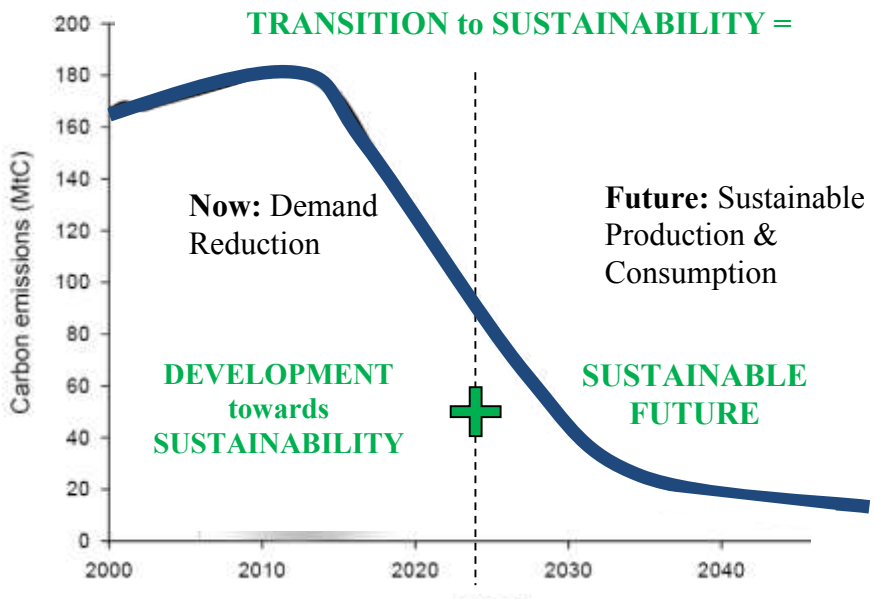


Figure 14: Twin Challenge for a Sustainable Transition of Industry and Investment
Source: Adapted from Anderson and Bows, 2008.

This figure highlights that this new economy should not be viewed as a renewable energy economy alone, or as an increase in certain types of green jobs. The new post-growth industrial and investment strategy needs to quickly displace the current approach that is driving the unsustainable expansion and increasing inequality of the UK economy.

8. Conclusion: How we can Make, Do and Mend a Shared Economy

Currently we have an economy that is despoiling our environment and any hope for a sustainable future. Our economy is broken: both socially and environmentally. Instead we need to mend our economy so that we can work together towards – and be gainfully employed in creating – a sustainable future, both in the UK, but also as part of a global economy that makes sense for the long term.

This means we need a national strategy to create new local jobs and stop propping up an economy that is hung off skyhooks - neither city bankers, nor consumer imports, nor building the last crop of housing and roads over our countryside will help sustain us in the future. The new normal starts with us. It is people-centred, and must be sustainability-led, not led by developers of new houses, roads and high-tech solutions. We can make better use of what we've got. We can limit new investment to that with a positive energy return on energy investment and avoid waste – such as converting oil platforms into floating wave and wind generators. And we can direct this planned approach to provide new semi-skilled jobs for the one in four of our working age citizens who want some or more work. This approach will mean building up and empowering individuals and restoring community trust, rather than dumping big box stores where we had vibrant town centres, and adding high-speed transport connections in the promise this will do more than increase distance travelled. Our throw-away society leaks jobs. Local jobs will cut waste and leakage of money and resources and create the connectivity for good work needed to trickle across our society. We can re-occupy our high streets and reclaim empty buildings for new eco-social enterprises. The Green New Deal should start by retrofitting a million empty homes and buildings. This would have a positive energy return on energy invested. We need to create carbon positive public houses (pubs) as well as public transport. We need an economy on one-planet principles, which won't happen unless we divest from fossil fuels and remove the perverse incentives that underpin current business-as-usual.

There is currently too much industrial production and investment for the UK to be sustainable. The first challenge is to stop extending both the scale of our physical 'built' environment and levels of consumer consumption yet further.

Viewing sustainability as just part of our industrial and investment strategy, as an added extra number of green jobs or renewable energy capacity is inadequate. It is not a question of making our existing unsustainable growth greener, but first making it smaller relative to the scale of our environmental resource and climate limits, our communities and society. The former means less production. The latter means that much of our consumption might be shared and publicly accountable, so no longer reflected in monetary exchange. And unless this is a combined approach, drawing together social and environmental sustainability, reflected in a multitude of interlocking local and sub-regional economic strategies, it will be insufficient.

So instead of letting speculative development and the huge global corporations lead us towards increasing levels of CO_2 emissions, inequality, unsustainable resource use and debt, we must stop expanding and

simplify our economy so that it is people-centred. With ingenuity replacing the industrial engine of growth and a desire to protect and sustain trumping the desire to divert the power of nature for the benefit of mankind.

This is not a massive engineering and industrial challenge, more a flood of challenges to our ingenuity and collective intelligence to unpick the way that continued infrastructure expansion and consumerism have locked us into existing ways of living. We can replace global monopoly with local and sub-regional economies built from the bottom up. Such an approach to economics is ecological and empowering. So instead of the frustration of, “but all I can do is change a light bulb” in response to seemingly insurmountable global intransigence, we can work together, going with the grain of nature, to *change*, to create an economic strategy that can be built by people not industry.

EF Schumacher (1972, p318) ended *Small is Beautiful* with these words:

> *Everywhere people ask: 'What can I actually do?' The answer is as simple as it is disconcerting: we can, each of us, work to put our inner house in order. The guidance we need for this work cannot be found in science or technology, the value of which utterly depends on the ends they serve, but it can still be found in the traditional wisdom of mankind.*

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