Demanding less:

why we need a new politics of energy

by Rebecca Willis and Nick Eyre

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Green Alliance

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Introduction

For generations, human development has been fuelled by ever greater amounts of energy. The discovery of fire by our earliest ancestors allowed them to harness the energy stored in plants to keep warm and to cook. Agriculture is essentially a means of diverting sunlight into crops to provide easily accessible food. Farming liberated people from the daily hunt for sustenance, and allowed populations to grow. Exploitation of coal fuelled the industrial revolution and the development of urban societies. Oil for transport, and the development of electricity systems enabled modern society, with its ever increasing consumption and mobility.[1] Energy use and social progress have been inextricably linked. Until now. Now, it makes sense to use less energy, not more.

The unintended consequences of increasing energy use in the developed world now outweigh the benefits. Climate change is, of course, first on the list of unintended consequences. The carbon released by burning fossil fuels is changing the climate with serious risks for some of the earth's systems. But there are other consequences too. As

we use up the easily available stores of fossil fuels, we start to exploit insecure and hard to reach supplies, at massively increased economic and ecological cost. Our dependence on oil-rich states constrains the extent and consistency of the west's support for democracy and human rights in the Middle East. As developing countries increase their energy use, it is up to the developed world to allow them the resources they need. At home there are social consequences of being oil-dependent, from the social fragmentation brought about by suburban living, to the health problems associated with sedentary lifestyles.

"Our dependence on oil-rich states constrains the extent and consistency of the west's support for democracy and human rights in the Middle East."

Governments know that the era of cheap, plentiful energy is over. That's why energy policy in the UK is gradually being refocused around the goals of energy security and carbon reduction. But politicians have yet to grapple with the fundamental question: how to break the habit of generations, and use less energy, not more.

So, for the moment, we have an unsatisfactory compromise: government acknowledges the problems of climate change and energy security, but asserts that there is a known, manageable, technologically driven way through. From left to right, all politicians maintain that plans to increase the use of renewable energy, carbon capture and storage and nuclear power, combined with more efficient use of energy, will carry us through. The reality suggests otherwise.

Here, we describe the contradiction between current trends and future goals that politicians are, as yet, unable to confront. We start by looking at what we actually use energy for. How much of what we call progress, from modern agriculture to warm buildings and mobility, is dependent on abundant energy? We then examine the current politics of energy, particularly the myth that we can easily replace fossil fuels with low carbon alternatives.

In the face of all this evidence, we present the overwhelming case for rebalancing our energy system, to focus as much on demand reduction as supply. We look at what would actually happen if we got serious about reducing energy demand. What would it mean for how we live, where we live, how we get around and what we eat? And finally, we suggest how to begin: what steps, from the rhetorical to the practical, would help us to move toward a more honest and workable politics of energy?

"Governments know that the era of cheap, plentiful energy is over. That's why energy policy in the UK is gradually being refocused around the goals of energy security and carbon reduction."

Why do we need so much energy?

Energy has played a crucial, but hidden, role in world history, from the earliest civilisations to the current day. Agriculture diverted solar energy into useful outputs in the form of crops and edible animals. This freed people to think about more than subsistence, and allowed them to group together in villages, towns and cities, with resulting cultural and political developments. Literacy and democracy have been powered by the sun.[2]

The anthropologist Joseph Tainter, who studies the collapse of societies, points to energy availability as a driving force of development. Ancient civilisations, powered by solar energy captured through agriculture, had a simple solution to declining energy availability: they looked for new land. The Roman Empire's expansion was a response to declining agricultural output: "in ancient societies the solution to declining marginal returns was to capture a new energy subsidy".[3] Slave trades can be seen as a trade in muscle power; imperialism as the quest for control over energy and resources. When these supplies collapse or fail, so do the civilisations which rely upon them.

The most significant energy innovation in history has been the discovery and exploitation of fossil fuels. A few years ago, a little known US biologist, Jeffrey Dukes, was driving through the deserts of Utah on his way to a research station. As his car ate up the miles, he began wondering about the fuel in the tank, and the plants that it had come from. How many ancient plants, he wondered, had it taken to fill his tank and power him across the desert? He asked around but couldn't find out. "The more I searched, the more frustrated I got. No-one knew the answer."[4] So he did the sums himself. He worked out that twenty five tonnes of plant matter go into every single litre of petrol. So a fifteen mile commute burns around fifty tonnes of ancient plants. As Dukes memorably puts it, modern lives depend on burning buried sunshine: "I realised that nearly everything I do depends upon plants that grew millions of years ago; and that without them, my life would be completely different."[5]

"In the UK, we each use the equivalent of 112kWh of energy per day, about fifteen times as much as before the industrial revolution."

Developed societies, and the people in them, use a lot of energy. Add together all the fossil fuel energy that we use for food, transport, buildings and products, and the figures are staggering. In the UK, we each use the equivalent of 112kWh of energy per day, about fifteen times as much as before the industrial revolution.[6] Ninety per cent of this is from fossil fuels. US Energy Secretary Steven Chu likes to tell Americans that they each have the equivalent of a hundred slaves working for them, that's the amount of muscle power that would need to be substituted for fossil fuels. In an even more eccentric analogy, sociologist William Catton recently pointed out that every American uses so much energy that if it were food, each would be eating as much as a 90 foot long Brontosaurus every day.[7]

So what's it all for? Why do we need so much energy to power our lives? It's surprising how rarely this question is asked, especially if you think that,

for most of history, we've managed with much less and, indeed, that most people in the world still use a lot less energy than those in richer nations.

Getting a grip on the figures

Official government figures[8] offer four basic categories of energy demand: domestic, transport, industry and 'other final users', mainly commerce, agriculture and the public sector. There are two problems with this statistical convention: first, it doesn't say much about why we use the energy we do. For example, why are people travelling more than they used to? Second, it ignores embedded energy or carbon, ie the energy used in other countries to manufacture goods that we import.

What about carbon and other greenhouse gases? How much are we each responsible for, and why? In his book *How bad are bananas?*, Mike Berners-Lee tries to find out the carbon impact of everything, from sending a text message to the Gulf War. He bases his analysis on consumption, or demand, rather than production (supply). The table right shows how much carbon we are each responsible for, and what we use it for, on average.

This analysis throws up a number of surprises. The total amount of CO_2 per person is much higher: 16 tonnes per person, rather than the nine tonnes usually quoted, using figures based on production.[9] This is because it factors in all the carbon used in manufacturing products overseas, and from land use. There are also areas of consumption, like food and drink, which are far more significant sources of emissions than a conventional analysis implies.

What we use carbon for

Categories	Unadjusted CO_2e per capita	% of total
Household fuel	1.84	11.3%
Domestic vehicle fuel	1.45	8.9%
Household electricity	1.37	8.4%
Personal flights	1.25	7.7%
Travel by train, bus & other transport	0.44	2.7%
Car manufacture and maintenance	0.89	5.5%
Food & drink from retail	2.03	12.5%
Eating, drinking and staying away from home	1.14	7%
Electrical goods	0.27	1.6%
Other non-food shopping	1.62	10%
Other bought services (inc financial services)	0.80	4.9%
Water, waste & sewerage	0.40	2.5%
Health care	0.62	3.8%
Education	0.41	2.5%
Public administration and other public services	1.23	7.6%
Construction	0.54	3.3%
	16.28	100%

Source: Small World Consulting

Armed with this information, we can take a closer look at how energy is used, and carbon emitted, at home, for transport, through land use, for food and drink, and in industry (ie making and using things).

At home

Our homes are notoriously energy hungry. They account for around a quarter of total energy use. Understandably, policies to improve residential energy efficiency have been a major focus of UK energy demand policy. By the standards of other sectors these policies have been reasonably successful, with residential energy use falling since 2004, in particular driven by reductions in energy use for space heating as insulation levels and boiler efficiencies improve.[10] But the overall rate of reduction remains low, and household electricity use (at least until the recession) continued to rise. The fastest area of growth is the use of appliances, particularly consumer electronics and information technology, where electricity use now exceeds that for lighting and cooking combined.[11] The change is driven not by increasing energy use per appliance, but by the huge proliferation of energy using devices in our homes from less than 20 in the 1970s to nearer 50 today.[12] This rising level of consumption is the area where governments feel least able to intervene and, therefore, the least has been done to try to influence behaviour.

One of the upward pressures on household energy demand is that there are fewer people per house than ever before, resulting in an even greater increase in appliances per person than appliances per home. Demographic shifts, including an ageing population and more separated families, mean that we are living in smaller groups. The number of households in the UK is forecast to increase by 29 per cent over the next 20 years.[13] Not only does this mean that we will each use more heat, light and power at home, it also has implications for transport and land use, and the energy needed for both, as discussed below.

"One of the upward pressures on household energy demand is that there are fewer people per house than ever before, resulting in an even greater increase in appliances per person."

Fuel injection

Jane Austen's Emma is everything you could wish for in a Regency heroine: "handsome, clever and rich", as the book's opening sentence declares. Yet for all her sophistication, Emma has never seen the sea. When *Emma* was published, nearly 200 years ago, a trip to the seaside was a major undertaking. Today, we each travel an average of 18 miles a day, not including flights.[14] This would have been unthinkable in Jane Austen's day, and even as recently as the 1950s when the daily average was five miles.

In our society, work, school and shops are often a car drive away; holidays, for most, involve planes. The sociologist John Urry describes how western societies require people to travel to participate fully.[15]

Yet transport policies aimed at saving energy and carbon predominantly focus on improving the efficiency of vehicle engines, and promoting

alternative fuels or electric cars. Despite ample evidence that so-called smarter choices in transport demand can have a substantial effect on transport energy use[16] and that their long term potential is large,[17] they form a negligible component of current policies for emissions reduction. Existing strategies ignore the underlying reasons for our increased mobility, which are much more to do with land use and social trends than vehicle technology.

Shaping settlements

Hilary Mantel's novel, *Wolf Hall*, received critical acclaim for its description of the political intrigue of Henry VIII's court, and the cunning of Thomas Cromwell. But it is also a striking description of life in 16th century London. Cromwell and his cronies relied on the River Thames, and a brace of strong oarsmen, to get around the city. All the important buildings, including Cromwell's own house and the Tower of London, were close to the water. Before fossil fuels were used for transport, London was a long, thin city, spread out either side of the river. Few people lived more than half a mile from a boat.

As power sources changed, so did the shape of the city. The arrival of steam power and trains made development spread along railway routes like spokes on a wheel, with railway suburbs developing around stations. Oil and the internal combustion engine changed this yet again, spreading development into the spaces between the spokes and beyond.

Our cities have been shaped by energy, from the muscle power of rowers and horses onwards. In the US, where planning laws are far less restrictive than the UK, the car has allowed cities to sprawl in all directions. Atlanta is 120 miles wide. During the US housing boom, estate agents would tell their cash-strapped clients who couldn't afford to live close to city centres to "drive 'til you qualify". Since the recession, it is these same suburbs that have suffered worst, thanks to a toxic combination of crashing house prices and rising fuel prices.

"Before fossil fuels were used for transport, London was a long, thin city, spread out either side of the river. Few people lived more than half a mile from a boat."

Cromwell's London and modern Atlanta show that the way we use land is governed by the way we travel and vice versa. Settlement patterns also dictate carbon and energy use. Less dense housing has a higher surface area and, other things being equal, uses more energy. More dispersed development requires more transport, which is energy intensive. Lower densities make public transport less efficient, walking and cycling less attractive, and car use more likely. In any debate about housebuilding, the overall energy and carbon impacts of settlement patterns, not just the carbon costs of individual buildings, need to be considered. Yet the government has been silent on the carbon impacts of its proposals to reform planning policy, even though relaxing planning restrictions, scrapping density targets and supporting building on greenfield sites are likely to lock in high carbon lifestyles.

Eating oil

Fossil fuels have even shaped our animals. Before selective breeding, cows were rangy creatures, which ate grass, lived outside and produced modest amounts of milk. Today's dairy cow is a distant relative, a huge beast that, thanks to breeding over many years, can produce up to 60 litres of milk a day. But, in energy terms, you don't get something for nothing. She produces more calories because she eats more calories, not just grass but feed grown with fossil fuel-based fertilisers. She needs other energy inputs too, like a warm shed in winter, as she is not hardy enough to live outside. Once you start looking in terms of energy inputs and outputs, the modern dairy cow no longer seems such a good deal.

The ecologist Howard Odum showed 40 years ago how the grass-fed cattle of the subsistence farmer are actually far more efficient at converting energy into human food. As he wrote, "we are tempted to think human brilliance has mastered nature. However, the plain truth is that fuels are being substituted for plant and animal functions."[18]

"According to the government, the reduction in UK carbon emissions is more than cancelled out by imports."

The amount of energy needed (and greenhouse gases released) for agriculture is often hidden, because it is very hard to estimate with any accuracy, particularly if land use changes associated with agriculture are factored in. And a lot of food is imported so, as discussed below, it doesn't officially count in our statistics. Mike Berners-Lee's analysis, in the table on page six, shows that food and drink, not including eating out, counts for over 12 per cent of total greenhouse gas emissions. Yet there is virtually no government policy which is aimed at changing the way we produce, incentivising farmers for low energy farming, or how we consume, incentivising consumption of local and seasonal food.

Making things

In terms of energy demand reduction, industry is one area which, on the face of it, looks like a success story. Energy use has been steadily decreasing over the past forty years. This is partly because of improvements in efficiency. Energy consumption per unit of output has fallen by 27 per cent since 1990. But it has also been driven by the decline in UK manufacturing. Put simply, we are making less of what we consume and importing more. According to the government, the reduction in UK carbon emissions is more than cancelled out by imports. As an internal government briefing, obtained by a Freedom of Information request, states: "Total UK emissions have increased by 19 per cent since 1990. Net imported CO_2 emissions (embedded in the products and services UK citizens buy) have risen substantially. This has counteracted the 12 per cent reduction in UK domestic emissions."[19]

The carbon impact of energy embedded in imports is so large because many goods bought in the UK are produced in economies with low energy efficiency standards and extensive use of coal, the most carbon intensive fuel. A dollar spent on primary energy in China has three times the carbon of the equivalent spend in the UK.[20] As discussed

below, China is now introducing measures to improve performance. But, so far, offshoring manufacturing has resulted in higher emissions, while being recorded in the national accounts as exactly the opposite: lower emissions.

Why can't we carry on as we are?

Our exploitation of energy has been so successful that we now hardly notice its critical role in almost every aspect of modern life. We have consistently downplayed its importance in the major political and social advances of the past two centuries. Progress in education, social mobility, science and technology are celebrated; the role of cheap energy in making them happen has been ignored.[21]

"Progress in education, social mobility, science and technology are celebrated; the role of cheap energy in making them happen has been ignored."

The radical ecologist William Ophuls argues that "several centuries of relative abundance have completely transformed the face of the earth and made our societies and our civilisation what they are today: relatively open, egalitarian, libertarian, and conflict-free."[22] Yet Ophuls draws a frightening conclusion from this: that liberal democracy will no longer be tenable without the abundant natural resources that underpinned it. As ecological scarcity bites, we will return to pre-modern political systems and values. Whether or not you agree with Ophuls' pessimistic conclusions, the basic analysis that the values of modern societies currently depend on their material underpinnings, is persuasive. A radical change in the way we use energy is bound to influence, and be influenced by, our social values and political outlook.[23]

Yet, for now, energy remains largely invisible. Indeed physical remoteness from energy is a characteristic of the society to which it is so crucial. Only 50 years ago, most households were directly aware of the amount of energy they used from the weight of coal carried into the house. Today it flows in unseen through pipes and wires, and embedded in the multitude of products purchased, most of which are manufactured many miles away, out of sight from consumers.

The pervasive attitude that new energy infrastructure should not be seen may well be one of the reasons behind opposition to wind turbines and other renewable energy installations. But a sustainable energy system will not be an invisible system. Reconnection of people with the energy system is a pre-condition for the low carbon transition.

So, as we switch, as most accept we must, from fossil fuels to other, low carbon sources of power, we will no longer be able to take energy for granted in quite the same way. The way that we exploit energy is going to change, and we are going to notice. It took 500 million years to lay down the fossil fuels that we are burning through so quickly. We use around a million years' worth of stored plant energy per year.[24] We need to switch, instead, to using the sun's energy day by day, and from destroying buried natural capital, to using visible natural revenue.

"As we switch from fossil fuels to other, low carbon sources of power, we will no longer be able to take energy for granted in quite the same way."

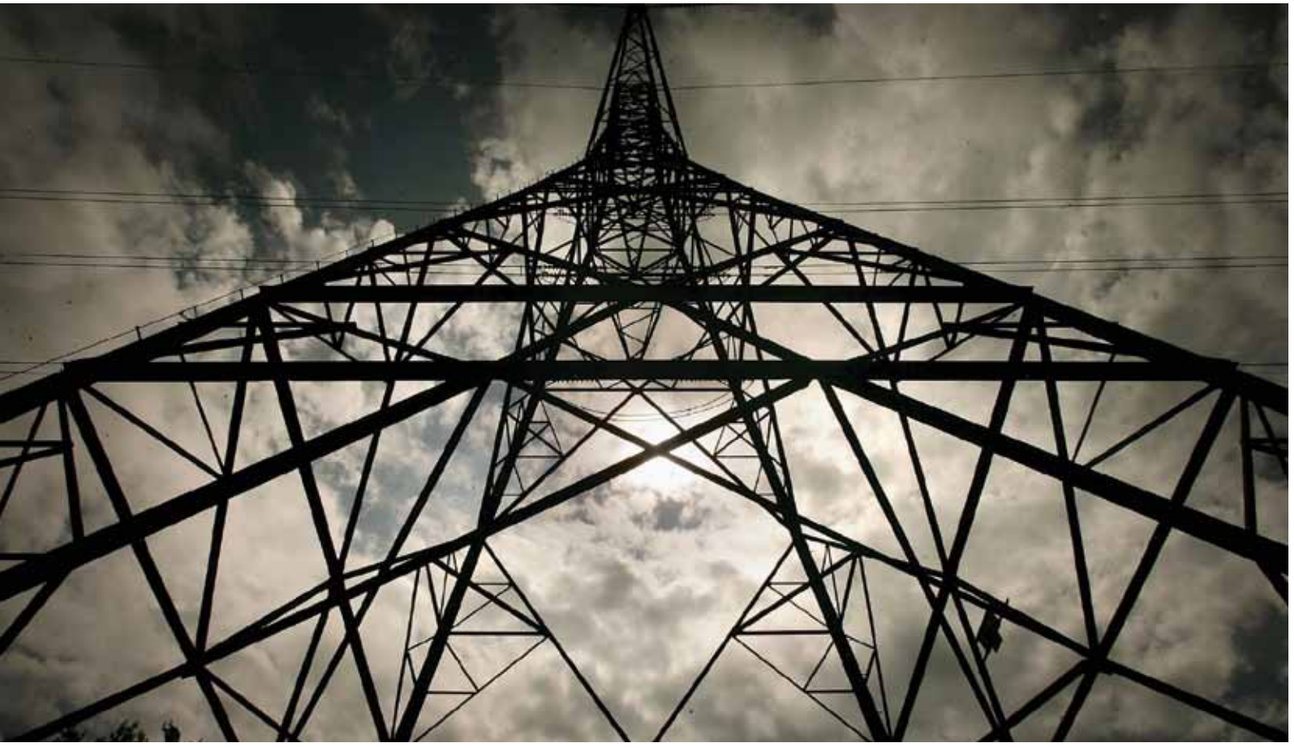
In theory, this shouldn't be a problem. The amount of solar energy hitting the earth each day is so vast that the amount used by humans will only ever be a tiny fraction of the total.[25] But the bigger limitation is the amount of productive land. Land is needed to turn solar energy into useable energy, whether through biological means, via photosynthesis into biomass energy and food; or through other forms of energy conversion, like solar and wind power. An influential study by ecologist Peter Vitousek, published nearly thirty years ago, measured the extent of human appropriation of 'net primary productivity', or the share of total biological productivity that is captured and used by people. He estimated back then that humans used 30 per cent of the earth's productive capacity.[26] A more recent account by Jonathan Foley confirms Vitousek's estimate and ends with the crucial question: "Ultimately, we need to question how much of the biosphere's productivity we can appropriate before planetary systems begin to break down. 30 per cent? 40 per cent? 50 per cent? More? Or have we already crossed that threshold?"[27]

Fossil fuels have allowed us to sidestep these questions of land use. Their energy comes from plants which grew millions of years ago, providing a one-off windfall. They didn't have to compete with other human uses for land. But now that they are becoming harder to exploit, and the unintended consequences of carbon emissions from fossil fuels have become apparent, we need to rethink. We need to look instead at how we can capture solar energy day by day, on a limited amount of land, and turn it into a useful source of power.

Technically, we know how. We can capture solar energy by growing crops or wood to burn, through solar cells, or through harnessing the wind. (Nearly all low carbon energy derives its power from the sun, including wind power, wave power and of course biomass energy. Only nuclear, tidal energy, which takes power from the moon, and geothermal energy, from the earth's core, do not rely directly on the sun.) But with less help from fossil fuels, the task is much harder. It requires land, quite a lot of land, in the case of biomass energy and wind power. And it requires research and innovation, in the case of wave power.

So this is the question that we now face. Modern society has developed and prospered thanks to the buried sunlight built up over millions of years. Can we now power society using just the energy that we harness day by day?

The supply obsession



It's clear that we need huge quantities of fossil fuels to live the way we do now. And politicians accept that we need to cut back drastically on fossil fuel consumption, to reduce carbon emissions and improve energy security.

Just before the last general election, spokespeople from the three main parties met at a hustings to discuss climate change.[28] Incredibly, for politicians, they agreed on nearly everything. That climate change is happening, and that it is a significant threat to global society. That the UK needs to cut its emissions of carbon dioxide and other greenhouse gases drastically, reaching 80 per cent reductions by mid-century.

"The solution to our energy crisis is almost always thought of predominantly in terms of energy supply."

They agreed, too, on the solution. They all said that we needed to switch from high carbon fossil fuels to low carbon alternatives. In other words, they argued that we can, and should, revolutionise our energy supply. They said virtually nothing about demand. When a questioner asked about the possibility of behaviour change and demand reduction as a complement to supply side measures, the response was dismissive. Demand side measures were instantly associated with frugality and denial, not the stuff of political inspiration. Conservative spokesman Oliver Letwin was amusingly frank: "Even if I would be happy to be the kind of person to constrain my life in all sorts of ways, and not heat the house much, and in my cold lonely existence also not eat much, as a politician I can tell you that this is not the manifesto which is going to win the next election."

It's not surprising, then, that the solution to our energy crisis is almost always thought of predominantly in terms of energy supply. If we can no longer get the energy we need from fossil fuels, it is argued, then we must look elsewhere. But as any economist will tell you, there are two sides to a transaction: supply and demand. Supply influences demand, and vice versa.

The obsession with energy supply has blocked out proper consideration of demand. This is deeply problematic. It ignores the fundamental question of why we use energy, what outcomes we are seeking, and whether there are other ways of achieving them. It doesn't allow us to question whether carbon targets and energy security would be better addressed by changing the way we use energy, rather than the way we supply it. It means that we remain vulnerable to energy supply risks, from well known geopolitical risks to the uncertainties of new technologies like carbon capture and storage. These problems will be discussed in more detail later. But first: how, and why, has this supply obsession developed?

The myth of substitution

It is clear from history that changes to patterns of energy exploitation have shaped our society. From early agriculture to the industrial revolution, energy has changed the way that we live, work and travel. Future impacts caused by a decline in fossil fuel use

will be similarly significant. But it is very difficult for politicians to talk openly about these likely future consequences. Rather than discussing the profound social and political consequences that we will be confronted with, it is easier to hide behind a powerful myth: the myth of substitution. That we can shift from high carbon to low carbon, without any real change to the way we live, and without people really noticing.

"The myth of substitution is all pervasive. Everyone from the Conservative Party to Greenpeace implicitly supports it."

The myth of substitution is all pervasive. Everyone from the Conservative Party to Greenpeace implicitly supports it. The assertion, in its simplest form, is that we can carry on using all the energy we want as long as it's low carbon energy. While most accounts are moderated by acknowledgement of the need for greater energy efficiency, they focus on an energy transition that is primarily about finding the right new supply technologies.

Following this logic, the obvious question is what will the substitute energy sources be? Numerous studies, by government and others, have developed scenarios for the substitution of fossil fuels. A central assumption of many scenarios is the switch to electricity as the dominant energy source across the economy, including for transport and heating, which implies a huge increase in electricity generation capacity. The Committee on Climate Change, for example, states that "the degree of heat and transport electrification by 2050 is such that the power sector may need to be around double today's size. This implies consistently high levels of investment in low carbon capacity over the next four decades."[29] This increase in generation capacity is a significant challenge.

All future energy generation models make massive assumptions about what will be possible. This is what they assume:

- **Huge amounts of capital investment.** The Committee on Climate Change assumes £16 billion annually in the 2020s (compared to the current £2 billion a year). Ofgem estimates that up to £200 billion will be required over the next ten years.
- **Market arrangements that make such investments possible.** The current programme of Electricity Market Reform attempts to do this, but it is not at all clear that any set of market reforms can provide a suitable investment environment for the radically different type of generation capacity the models assume.
- **Optimistic build rates for technologies.** On past record, they tend to be slower and more difficult to develop than anticipated. New nuclear stations, onshore and offshore wind, and tidal energy are all examples. In reality, planning issues, economic uncertainty and project management difficulties almost always conspire to slow down the rate of growth.

The developers of these models are generally under no illusions about how difficult it is to substitute high carbon energy with low carbon energy. All the reports are filled with caveats explaining the difficulties and obstacles. The message from them all is, "it's very difficult, but it might just be possible". With huge amounts of investment, bold government policy, a supportive public and a good dose of luck, we might just get there.

But somehow, the caveats get lost in translation. Politicians want to be able to tell a simple story about substitution of fossil fuels with low carbon energy. When the careful models, with all their caveats, risks and assumptions, enter politicians' speeches, the message changes. It is no longer a case of "it might just be possible". It becomes instead "this is our low carbon road map". The uncertainties are stripped away, and the myth of simple substitution prevails.

Because they assert that substitution is both a reasonable and a possible response, much less thought is given to the demand side, even though a reduction in overall demand for energy could be cheaper, and comparatively easier, though by no means easy, to bring about.

The energy supply gang

A second reason for the focus on energy supply, not demand, is that there is a clearly defined group of people and organisations who, between them, have responsibility for energy supply. Energy demand, by contrast, is diffuse, embedded in every nook and cranny of our economy, and not influenced much by what we might call energy policy.

What type of Contracts for Difference do you support? Is 'project discovery' a new space expedition or a set of energy scenarios? Are FiTs better than ROCs? If you know the answer to all of these questions, you are an official energy wonk. One of a small band of very knowledgeable specialists who help to make sure that our energy supply keeps going.

"Energy demand is diffuse, embedded in every nook and cranny of our economy, and not influenced much by what we might call energy policy."

Energy supply is a discrete technical domain. It consists of the extractors of coal, oil and gas, generators of electricity, and the distributors and suppliers of fuels and power. The sector is dominated by a small number of large companies, who try to provide as much energy as we need, at the least cost. They are supported by policy makers in government, primarily in the Department for Energy and Climate Change (DECC), who use policy to influence patterns of supply. Together they constitute, to adapt a phrase of Eisenhower's, an 'industrial political complex' within which energy policy is made and implemented. This complex has developed over the century, or since the rise of oil and electricity, as a key force in modern society.[30]

Privatisation and liberalisation in the 1980s and 1990s removed public sector monopolies in coal, gas and electricity, but the energy market it created, and its institutional and power relations, remain as dominated by supply side interests as ever.[31] The energy supply companies created by privatisation,

now consolidated into the so-called 'big six', have a remarkable hold over the system, not least because they are seen as a safe investment for pension funds.[32] It is their job to sell units of electricity and gas to customers; they do the supply bit, but not the demand bit.

Energy wonks do a good job. But it is a partial one. They are paid to think about energy supply, and about efficiency of energy use. There are plenty of things which have a huge impact on energy use, which are not considered by the energy policy community, at least not as part of their day job. They are not required to think about the energy and carbon embedded in imported goods, or about the energy implications of land use planning, or the energy used in food production or food waste.

"The energy supply companies created by privatisation, now consolidated into the so-called 'big six', have a remarkable hold over the system, not least because they are seen as a safe investment for pension funds."

But they are, on a daily basis, confronted with the enormous challenge of guaranteeing a secure energy supply, while drastically reducing carbon emissions. Recently, a huge amount of effort has gone into trying to predict the ways in which we will meet this challenge. The Department of Energy and Climate Change, for example, has produced a set of scenarios, the 2050 *Pathways analysis*. This sets out different ways in which the UK could meet its carbon targets. An interactive website allows people to play around with different combinations of technologies and approaches: nuclear, renewables, carbon capture and energy efficiency, and decide which combination would work best.

While the scenarios acknowledge that energy demand could be reduced, and explore quite a wide range of possible futures, the use of energy demand reduction is seen largely as a result of supply side failure. For example, if carbon capture fails, then energy demand needs to be reduced. The majority of pathways in the recent DECC analysis[33] assume rather unambitious changes to energy demand, for example that household energy use rises, even though it is now falling. It is assumed that car use cannot fall below 62 per cent of distance travelled, despite peer reviewed scenarios with more radical change.[34] In contrast, on the supply side, the majority of pathways assume historically unprecedented rates of nuclear build.

Meanwhile, the energy regulator, Ofgem, has been having some pretty far reaching thoughts about energy supply. Established in the 1980s to oversee the newly privatised energy industries, its role is to promote competition and protect the interests of energy consumers. It is not known for its radical thinking. So it was a surprising departure when, in 2010, it published *Project discovery*. This fundamental re-analysis of future energy markets predicted massive price increases for consumers, possible blackouts and missed carbon targets unless significant changes were made to the way we manage energy supply. Even more surprising was the list of possible responses that Ofgem put forward. The most radical idea was to introduce a Central Energy Buyer, involving total centralisation of wholesale electricity markets, remarkably similar to the nationalised structure which preceded Ofgem's creation.[35] Although this option was not seriously discussed, it is a mark of the seriousness of the situation that such a suggestion even appeared in an Ofgem document. Rising consumer prices continue to pressure Ofgem and government into considering more interventionist approaches to the large energy companies.

"To influence energy demand, we actually need to influence purchasing decisions, building practices, land use, agriculture, food, transport and settlement patterns, and trade flows."

But, although these reports come to some surprising conclusions, they still fit firmly within the energy supply box. The 2050 scenarios and *Project discovery* make plenty of assumptions about energy demand, about how much energy we will need to heat our homes, drive our cars and power our industry. But these assumptions are static. Demand is taken as a given. The solutions put forward are all supply side solutions, or proposals to increase the efficiency with which we use energy.

To influence energy demand, we actually need to influence purchasing decisions, building practices, land use, agriculture, food, transport and settlement patterns, and trade flows. Energy experts, in government or in energy industries, don't tend to discuss these drivers of energy demand, because they don't have the right influence or expertise. They concentrate on what they know about: energy supply. It is in their interests to work to a narrow definition of energy policy, focused around supply, rather than trying to tackle the bigger, more diffuse issues.

Meanwhile, people involved in these wider issues, experts in design, construction, transport, land use planning, farming or trade, don't usually examine the energy implications of what they do. In other words, they don't know how serious the energy challenge is, because energy experts have encouraged the assumption that we can find the energy somewhere and plug the gap.

There is precious little dialogue between energy experts and these other domains. This even causes problems for energy generation. The relatively low uptake of onshore wind in the UK owes much to the failure of most energy experts to notice, at least until very late, that the traditional model of energy supply investment provided little incentive for those involved in land use planning and economic development to be supportive. And when they weren't supportive, the wind developments didn't happen.

The cracks appear

The idea that we can solve our energy crisis through finding the right mix of low carbon energy, and that we can rely on the experts to find a technological solution, is incredibly powerful and widely repeated. But these are dangerous assumptions. A closer examination reveals that it is demand, not supply, that is paramount. Changes in energy demand, due to wider economic shifts, are a very important driver of the energy system. Efficiency has improved markedly, but its effect has been cancelled out by increased economic output. Improving and decarbonising the energy supply is much more problematic than it is often assumed. There are deep uncertainties surrounding the speed of deployment of many low carbon technologies which form the backbone of future energy strategy.

The significance of the demand side

Though the energy mix has changed over time, with a switch from coal to gas (the so-called 'dash for gas'), the nuclear programme and new renewable energy generation, the effect of these switches has been far less significant than structural economic change. Globally, there has been significant decoupling of economic growth from rising energy use with a 40 per cent improvement since the oil crises of the 1970s. This decoupling has produced six times as much carbon emissions reduction as all the changes to the global fuel mix.[36] In the UK, the energy to GDP ratio, ie the amount of energy per unit of GDP, has fallen by 55 per cent since 1974, over which time the fuel mix has decarbonised by just 14 per cent. Improvements in energy efficiency and restructuring of energy demand across the UK economy now contribute about four times as much to UK carbon emissions goals as the gas, nuclear and renewable programmes combined. In other words, changes to energy use, not the energy mix, have driven carbon reductions.

"Changes to energy use, not the energy mix, have driven carbon reductions."

Of course, some of this improvement has come from restructuring the UK economy away from manufacturing and towards services. On a consumption basis (ie accounting emissions embedded in traded products and services with the consuming country not the producer) total UK emissions increased by 13 per cent between 1992 and 2004.[37] This is because the CO_2 emissions embedded in imported products and services rose hugely, offsetting the modest reduction in UK domestic emissions.

But the same analysis shows that the key driver of energy use is a 49 per cent increase in economic consumption. Structural change only reduced emissions by eight per cent, compared to 27 per cent from greater efficiency. To the extent that emissions are being decoupled from economic growth, it is improved efficiency that has been the dominant contributor.

What is perhaps more remarkable, are the energy demand changes achieved without draconian public policy intervention. Partly, of course, they are the result of technical progress and the turnover of capital stock in the economy. But rather mundane, and relatively cheap, public policies have played an

important role: standards for electrical products and boilers, building regulations, industry Climate Change Agreements and transport fuel taxes. Moreover, this has largely been achieved without the subsidies currently received by the renewables sector, likely to be given for carbon capture and storage (CCS) and always provided for nuclear.

"What is perhaps more remarkable, are the energy demand changes achieved without draconian public policy intervention."

But will we run out of opportunities for energy efficiency improvements? The answer seems to be "not any time soon". According to the Intergovernmental Panel on Climate Change (IPCC), the potential for energy saving to reduce global greenhouse gas emissions at reasonable cost (below $100/tonne CO_2 equivalent) is more than three times the equivalent number for energy supply.[38]

It should not be assumed that energy demand changes are only the cheap, easy and short term part of addressing climate change. Thermodynamic assessments estimate that the efficiency of energy conversion along the whole chain from primary energy to the point of use is approximately 11 per cent of the theoretical optimum and the efficiency with which services are then provided by that energy is then only a quarter of what might reasonably be achieved. In other words the current global energy system is less than three per cent efficient compared to what might be thermodynamically possible.[39]

Such figures may be surprising at first sight, but there are some increasingly well known examples. In the UK's climate, the energy required to heat a building to a comfortable temperature can be provided from body heat and sunshine alone. So a 100 per cent reduction in space heating demand is perfectly possible. Designing, building, maintaining and operating such buildings is certainly a challenge, but then so are the energy supply alternatives.

Despite improvements in efficiency, energy use is growing globally and, even with the help of some exporting of manufacturing, only falling slowly even in the UK. The underlying problem is that, although our buildings, cars and industries have become more energy efficient, we are continuing to consume more. This is partly due to the opportunities and savings realised by energy efficiency itself, the so-called rebound effect.[40] But far more important is the general propensity to consume more as real incomes rise. So energy reductions from efficiency savings are cancelled out by more consumption elsewhere in the economy, with consequently more carbon emissions, often imported.

Supply side uncertainties

Efficiency improvements, and changes to demand, have been much more important than we realise, and will continue to be. Meanwhile, on the supply side, the situation is far less straightforward than politicians admit. Recently, major energy shocks have dented public confidence in the reliability and competence of the energy supply industries.

Last summer's oil spill in the Gulf of Mexico raises question marks for the economics and acceptability of oil from increasingly difficult locations, not just in deep water but also from the Arctic and oil shale reserves. The controversies surrounded shale gas continue to grow on both sides of the Atlantic. These are more than minor irritants for the petroleum industry. The idea of real limits to readily accessible oil and gas resources ('peak oil') is now very far from being the reserve of transition town activists; it is increasingly acknowledged by mainstream analysts and even the International Energy Agency.[41] So the resources that are proving technically and politically problematic are those resources on which the medium term future of the oil majors increasingly depends.

"The resources that are proving technically and politically problematic are those resources on which the medium term future of the oil majors increasingly depends."

Even if there were plenty of easily accessible oil left, we would not want to take it out of the ground. Nor would we want to exploit all the world's coal resources. To do so would cause atmospheric carbon dioxide to rise to dangerous levels. The IPCC estimates that fossil fuel reserves still contain 4.7 trillion tonnes of carbon,[42] but the safe limit to cumulative human emissions is thought to be around one trillion tonnes,[43] of which half has already been emitted. So we can only burn ten per cent of the estimated remaining reserves. This is a difficult finding. Either we breach carbon limits, with catastrophic consequences for planetary systems; or we leave most fossil fuels in the ground, unless we can find a workable system for carbon capture. As a report by the Carbon Tracker initiative points out, this means that oil, coal and gas companies are dangerously over valued on stock markets,[44] a financial bubble which will, at some point, burst. As the International Energy Agency's chief economist memorably said, "we have to leave oil before it leaves us."[45]

Meanwhile, the predicted nuclear renaissance is slow to emerge. The technologies upon which it is predicated are proving more difficult and expensive than projected in both France and Finland.[46] The Fukushima nuclear disaster, whilst apparently leaving UK public policy unchanged, has already changed policy elsewhere, notably in Germany. This combination is beginning to dent the confidence not only of investors, but also of nuclear suppliers and generators themselves. As German companies' home markets disappear their willingness to invest in a UK nuclear renaissance also declines, raising real doubts about its commercial viability.[47]

CCS is the only hope for the fossil fuel industries to avoid serious contraction if carbon emissions targets are to be met. Yet, despite a 20 year international R&D programme confirming the technical viability of each aspect of the technology, there is no commercial scale example of power generation using CCS. The UK stated its commitment to a large demonstration programme, but delays mean that it is very unlikely that the technology will be commercially viable by 2020.

Renewables development in the UK has been notoriously slow, leaving the UK near the bottom of the European league table with respect to the renewable share of power generation. A variety of causes have been suggested, ranging from the financial support mechanism (obligations as opposed to feed-in tariffs) to NIMBY influences in land use planning and delays in building transmission capacity. Underpinning most of these is the UK's characteristic preference for market based solutions. Current renewable energy targets are widely judged to be very challenging. They lean heavily on a future role for offshore wind that aims to make the UK the market leader in this field. But costs have remained higher than expected[48] and, therefore, so have the required subsidies from government or consumers.

With controversy over rising prices and falling government budgets, future volumes of offshore wind and other renewables remain uncertain, particularly beyond 2020.

"We should take a serious look at reducing demand, not just as an afterthought to make decarbonisation easier, but as the centrepiece of policy."

In summary, the development path for all low carbon supply options: carbon capture, nuclear, and renewables, is far from straightforward. This doesn't mean that we should abandon attempts to decarbonise our energy system, far from it. But it does mean that we should take a serious look at reducing demand, not just as an afterthought to make decarbonisation easier, but as the centrepiece of policy.

Shaping a low energy society

Our energy supply capabilities are stretched to breaking point. Yet we are stretching them even further, rather than asking the simple question of whether we need to use as much energy as we do.

The central conclusion of this paper is deceptively simple. It is this: that we should put as much, if not more, emphasis on energy demand reduction as we do on energy supply. This emphasis should be explicit: we should acknowledge that we cannot just predict and provide energy and that we are pushing up against biophysical limits of the amount of energy that we can extract for human use. It should be moral: that developing countries have a greater need to increase their energy use than we do. It should be technical: looking for policies and solutions that reduce demand, rather than pinning hopes just on low carbon supply. And it should be financial, with as much investment in demand reduction as in supply capacity.

So what would a more effective, integrated and honest approach to energy politics look like? How could government get serious about energy demand reduction? What would politicians have to do to begin to shape a low energy society?

The first step in a new politics of energy is to set a goal of a low energy future, explicitly addressing energy use, not just energy supply. This is not to downplay the importance of energy supply, but to stress that we cannot rely on a predict and provide approach to the energy we need.

Energy needs to be seen as a public good, not a private commodity. Government needs to play a role in shaping energy outcomes, in the same way that it shapes health and education outcomes. This means policies and incentives to shape the way that people use energy, both directly and indirectly.

"We should acknowledge that we cannot just predict and provide energy and that we are pushing up against biophysical limits of the amount of energy that we can extract for human use."

This shift in approach will create the conditions for new policies, from a focus on low carbon supply and efficiency to policies that encourage absolute demand reduction. The policy detail will be complex and difficult, but we need a relentless focus on how we can use less energy, in our homes, getting around, and in the products and services we consume.

It requires fundamental changes in four areas:

1. linking to people's lives;
2. investing in demand reduction;
3. spreading the effort across government; and
4. honesty about international transfers of energy and carbon.

1. Linking to people's lives

This new approach is about influencing energy demand, rather than relying on supply side solutions. It means searching for ways to influence lifestyles and patterns of behaviour. The government has taken considerable interest in influencing behaviour, taking a cue from the bestselling *Nudge*,[49] which examines how behavioural science can be used to achieve public policy goals. This is useful, because it moves beyond the simplistic assumptions of most economic analysis to a behavioural economics that draws on a more nuanced and realistic view of human psychology.

Yet 'nudge' thinking is essentially individualistic in approach, and the complexities of energy use require social, not individual, responses. The assumption is that energy behaviours are personal choices that respond only to incentives. Most energy research indicates that this is, at best, an unconvincing assumption for dealing with the complexities of energy use, particularly in the context of the problem of transforming highly networked energy systems to deliver the collective goals of climate stability and energy security.

"The complexities of energy use require social, not individual, responses."

Most energy using practice arises from a combination of factors. New purchases, eg of homes, cars and appliances, are highly influenced by marketing with limited incentives to reduce demand, and habitual routines, such as heating and lighting control, and food and hygiene practices, are strongly influenced by social norms and purchases already made. The attractiveness of many low energy options, notably the use of alternative transport modes, is determined very largely by land use patterns and infrastructure which are not able to be influenced by individual choice. This is well documented in academic social sciences[50] and the implications for more community based approaches are set out in various policy reports.[51]

Large scale change in centralised supply side technologies can be delivered by a technical elite, but demand side change requires engagement of a more complex set of actors: from politicians to citizens, from product technologists to small builders and from the traditional energy sector to companies engaged in construction, transport, agriculture and food.

Linking to people's lives also means a particular focus on social justice. Poorer households spend a higher proportion of their income on energy, particularly direct energy in the home. Existing statutory goals for fuel poverty eradication are already extremely unlikely to be met.[52] If energy demand reduction is achieved through individualised nudges and financial incentives, this is likely to impact most negatively on poorer households. Socialised approaches, tackling the structural causes of high energy demand, will not only be more effective but will have positive social benefits too.

2. Investing in low energy infrastructure

To get serious about demand reduction, we need to invest in low energy infrastructure, not just low carbon supply. As the International Energy Agency has made clear, investment decisions over the next decade will determine whether we meet carbon targets. Every new carbon intensive investment today, whether a car, a road or a new site for shale gas exploitation, locks us further into a high energy economy.[53]

We need to shift focus from the supply of units of energy, which is what the energy market is designed to do at present, to investment in the infrastructure which allows people to use fewer units of energy. As Walt Patterson writes, "we have to refocus policy away from supplying commodity fuel to investing in user technology and user infrastructure."[54]

This means breaking down the barriers between supply on the one hand and demand on the other. It means investing in energy infrastructure in communities, particularly renewable heat and electricity. It is still very difficult and expensive to get many small scale schemes off the ground, and a tiny fraction of energy generation capacity, less than one per cent, is owned by communities, rather than the private sector. There is no reason why all types of energy generation, large and small scale, should not be community owned, as is the norm in Denmark. But in this country, we have channelled community ownership into a small scale niche and, under the current structure of the energy market, it is likely to remain there.[55]

3. Spreading the effort across government

As the above analysis shows, there are huge sources of energy use that have been largely ignored by energy policy: energy from food and drink consumption, air travel, waste and resources. Policies and incentives are overwhelmingly concentrated on a small, albeit significant, area of energy use: direct energy use in homes and, to a lesser extent, transport. Lots of effort is expended trying to get people to insulate their homes, but very little thought is given to the energy embedded in the food that we eat, despite its significance for both energy consumption and carbon emissions. There are incentives to drive more efficient cars, but very little is done to discourage car dependent settlement patterns.

"A refocused energy policy would start by looking at the most significant areas of energy consumption, both direct and indirect, and make sure that energy demand reduction was incentivised accordingly."

A refocused energy policy would start by looking at the most significant areas of energy consumption, both direct and indirect, and make sure that energy demand reduction was incentivised accordingly. A step in this direction was made in 2009, when individual government departments were given their own carbon budgets, but the current government has not continued this process.

Local government, too, has a crucial role to play, yet a recent Green Alliance analysis shows that local authorities are scaling back their work on climate change and energy, rather than taking a more active role.[56]

Who, in government, would need to do what if we are to spread responsibility for energy? Here is what the different areas of government could do:

Department of Energy and Climate Change (DECC): DECC has responsibility for energy supply, and energy efficiency. However, it should acknowledge that it cannot directly control energy demand across the economy. It needs to build a stronger outreach function, working closely with other government departments to influence the root causes of energy demand, in the same way that the Treasury maintains a continuous dialogue with departments about public spending.

Department for Communities and Local Government (CLG): Serious energy reduction will only happen if land use planning focuses much more on creating energy efficient settlements. Compact development should be encouraged, as it reduces travel distances, makes public transport more efficient, and encourages walking and cycling.[57] It also creates opportunities for district heating and community level energy generation.[58] There are considerable social benefits from this approach too.[59] In the US, where decades of cheap oil and lax planning have resulted in dispersed development and car based transport, there is now an influential Smart Growth movement advocating compact towns and walkable neighbourhoods, based around hubs of retail and employment services, close to transport interchanges. The considerable irony is that this is essentially a recreation of an enduring form: the town centre. However, the current planning reforms are likely to make it more difficult to reduce energy use, as they will make it harder to enforce density standards or brownfield development.

The number of households in the UK is increasing, and is forecast to increase by 29 per cent over the next 20 years.[60] The fewer people per household, the less viable local services are, making it harder to create compact, walkable communities. Policies to encourage larger households would help greatly. This is a tricky issue for government. It is seen as a private choice, not to be interfered with. But isolation and social exclusion of elderly people is not a policy objective, so there is much that could be done through incentives and support, rather than sanction. Older people living alone, who wanted to move, could be helped, financially and practically.

As increasing amounts of land are used for renewable energy, difficult decisions will need to be made, globally as well as nationally, about the conflicting needs of agriculture, biofuels, landscape and biodiversity. We are already seeing the emergence of fierce political battles over wind farms, with many MPs and local councillors opposing proposals for wind farms in their areas. The existing land use planning framework dates from the post-war Town and Country Planning Act. Although farsighted at the time it is now inadequate in rural areas, because the post-war assumption of the universal desirability of intensive food production is now neither correct nor relevant to many planning decisions.

"The post-war assumption of the universal desirability of intensive food production is now neither correct nor relevant to many planning decisions."

Department for Transport (DfT): Given the significance of energy use and carbon emissions from transport, it is surprising that policies for sustainable transport are still a minor part of the Department for Transport's agenda. Radical reductions in transport emissions are possible, but

they require progress on reducing the need to travel and modal shift, as well as vehicle technology.[61] The DfT focuses predominantly on the last of these; it could work much more closely with CLG to develop settlement patterns which made public transport, walking and cycling more viable. The success of the Sustainable Travel Demonstration Towns shows that a focus on transport demand management is a cheap, effective and socially just way of reducing carbon and energy use. Yet the roads budget still outweighs the money spent on demand management by a factor of 32 (£115 million on 'sustainable travel' compared to £3.79 billion for roads).[62]

Department for Environment, Food and Rural Affairs (Defra): Farming, food production and consumption is very significant in terms of both energy and greenhouse gases, particularly methane. Yet there is precious little incentive from government for farmers to address the issues. Farmers should be encouraged to invest in renewable electricity and heat, and rewarded for saving energy and greenhouse gases. These issues could be incorporated into Stewardship Schemes for land management. Policies to encourage local and seasonal food would also result in significant energy and carbon savings.[63]

Defra also has responsibility for 'sustainable production and consumption', and, in this role, can help reduce energy demand from consumption, particularly household and commercial sector appliances.

HM Treasury and the Department for Business, Innovation and Skills (BIS): With responsibility for setting long term economic and industrial policy, these departments are central to creating a lower energy and lower carbon economy. However, in times of economic crisis, the instincts of the Treasury and BIS are still to stimulate consumption without much reference to the impacts on carbon emissions or energy use. Our analysis shows that a return to consumption driven economic growth does not offer a long term sustainable path. The current mainstream economic debate is essentially between the Keynesian and monetarist approaches to returning to economic business as usual. But business as usual is unsustainable. The debate needed is more fundamental, about how to secure useful work and fulfilling lives in different ways. There is no easy solution, but giving priority to low carbon infrastructure in spending decisions would be a good start.[64]

"The current mainstream economic debate is essentially between the Keynesian and monetarist approaches to returning to economic business as usual. But business as usual is unsustainable."

Local government: Greater emphasis on carbon saving through changes to settlements and local transport essentially puts the role of local government at the forefront of energy policy making and politics. There are many ways in which local government influences energy use:

- planning, economic development and regeneration functions, which can help to create compact communities;
- as a planning authority, bringing forward plans for renewable energy;
- transport provision, providing both capital and revenue for transport services;
- as a housing provider in low carbon refurbishment;
- direct contact with local residents, and the opportunity this provides to encourage behaviour change;
- potentially, as an owner of energy generation assets such as district heating schemes or distributed renewables (Birmingham and Woking are two examples of local authorities that own energy assets);
- influence as an employer, procurer of goods and services and facilitator of local partnerships.

Despite the crucial influence that local government can have, current policy is moving in the wrong direction. Local authorities have no statutory duties to reduce carbon or to play a role in energy demand reduction, neither are they rewarded for doing so. None of the localism provisions do much to promote alternative business models for energy or transport and the underpinning assumption in planning, that local authorities and local communities are in conflict, is not helpful.

Green Alliance's recent survey of councils showed that two-thirds saw no role for themselves in encouraging carbon reduction in their local area.[65]

A new approach to energy would put local government at the centre, with incentives for them to take an active role in decentralised generation and energy saving, while promoting low carbon transport systems and settlement patterns.

"Green Alliance's recent survey of councils showed that two-thirds saw no role for themselves in encouraging carbon reduction in their local area."

4. Honesty about international transfers of energy and carbon

The evidence cited above leaves no doubt that the emission trends in the UK, and other developed economies, are considerably worse when measured on a consumption basis, rather than the territorial (production based) emissions reported under the Kyoto Protocol. Whilst it can be argued that consumption based emissions accounting would be fairer, the political and methodological problems in changing the international reporting regime are significant. Arguments for changes are not incontrovertible, as newly industrialising countries clearly benefit economically from the goods with embedded energy and carbon that they export. So we do not argue that a change in the international reporting methodology is critical. But honesty about the analysis is needed. Developed world consumption remains the key driver of climate change. One of the arguments of the climate sceptics, that developed world emissions are irrelevant because of rising emissions from China, is undermined when consumption accounting is used. So we believe that twin-track reporting (using production and consumption bases) should be instituted as soon as possible.[65]

Conclusions

To improve the social and environmental impacts of energy generation we have to address energy demand. We can't tackle climate change and energy security without reversing our growing use of energy. For two hundred years, economic growth has been enabled by access to cheap, abundant fossil fuels. Change this variable, and the economy itself changes, and society with it. Outcomes may not be worse, but they will be different. As the politics of power moves to centre stage, the role of energy as a driver of social and economic progress will be better understood, and greater understanding may well lead to better decisions about how to shape our society.

"We need a new approach to thinking about energy, one that starts from how and why energy is used rather than assuming that progress is intrinsically linked forever to rising energy demand."

We need a new approach to thinking about energy, one that starts from how and why energy is used rather than assuming that progress is intrinsically linked forever to rising energy demand. Economic change, social change and behavioural change can all affect energy demand in either direction, and policy can have an impact on all of these. Energy policy based largely on energy supply is not only inadequate, it is misleading and potentially damaging.

An extension of energy policy to energy demand is critical and, whatever the rhetoric about energy efficiency, the current approach does not provide this. Energy demand should be considered broadly, the real drivers need to be addressed, not just in policies for buildings, industry and transport but also in those usually considered for food, planning and trade.

For a number of years, the UK has had an apparent cross-party consensus on climate policy. This consensus is looking more fragile, and may not survive the impacts of recession and budget reduction. Even if it can, it is not helpful if it continues to reinforce the myth that all that is needed is to plug in new forms of power generation. Climate change is driven by energy use and energy use affects all aspects of modern life. Energy affects people unevenly, poor people more than rich, rural dwellers more than urban, industrial companies more than services. So a more holistic energy policy should be the stuff of politics. The small number of incumbent companies that dominate the energy sector today, and help define the inadequate scope of current energy policy, do not provide a power structure that is immutable or inevitable. Energy history has not ended.

So, whilst we welcome a broad acceptance of climate policy objectives, energy policy as the means of delivering them should be expected to be contested, political and controversial. We need to put as much emphasis on energy demand reduction as supply substitution, and rebalance policy to develop a new politics of energy demand reduction.

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