# Enough is as good as a feast – sufficiency as policy

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## Abstract

The concept of sufficiency has a long history, related as it is to the timeless issues of how best to distribute and use resources. Where energy is concerned, absolute reductions in demand are increasingly seen as necessary in response to climate change and energy security concerns. There is an acknowledgement that, collectively if not individually, humans have gone beyond safe limits in their use of fuels. The relatively wealthy and industrialised nations urgently need to move beyond a primary focus on efficiency to the more contentious issues surrounding demand reduction and sufficiency.

The paper considers definitions of energy sufficiency, looks at a recent attempt to model future energy use in terms of efficiency and sufficiency, and discusses quantitative and qualitative aspects of sufficiency and how they might become institutionalised. There are many arguments in favour of sufficiency but they often founder in the face of political requirements for market growth and the employment generated by it. Some options for 'sufficiency policy' are selected, including a focus on energy in relation to livelihoods, energy implications of our use of time and making energy use more transparent.

## Introduction

The challenging concept of sufficiency has been with us for a long time. As individuals, we are used to making decisions based on what we know to be 'enough' or 'too much' from our experience of life (too much chocolate makes you ill) or from what we have been told by others (it is unacceptable to wear expensive designer clothes to school; such-and-such a kitchen appliance takes up too much space and is difficult to clean, so it's not worth buying). Sufficiency can be broadly defined in two ways. One is qualitative, implying wealth and plenty: sufficiency means that a purpose is achieved, a need is satisfied and some sort of optimal state has been reached: 'enough is as good as a feast'. By implication, 'enough' is something to be celebrated and relished. It is subjective in nature and so is normally used in relation to an individual. Sufficiency may be a relative or an absolute concept when this type of definition is used.

The second type of definition is quantitative, implying a clear *threshold* of acceptability: do we have enough food for the day? Is the rainfall this spring sufficient to allow the crops to grow to harvest? Is the supply from x power stations sufficient to meet national demand, without needing to import electricity? Is 450 ppm of carbon dioxide in the atmosphere sufficiently low to prevent runaway global warming from occurring? Quantitative sufficiency thus implies 'floors' (enough for a necessary purpose) and 'ceilings' (too much for safety or welfare, in the short or long term). It is more objective in nature, using absolute points of reference.

One of the greatest difficulties in using sufficiency as a concept is its normative or moral dimension. Every day we have evidence that judgements differ on what is sufficient. It may be relatively easy to agree at the bottom and top of a scale of affluence: for example, that everyone has a right to clean water, daily food and basic shelter, while no one has an unquestioned right to go heli-skiing. Meeting absolute need, the need for water, food, care and shelter that is experienced by humans in any situation, has to be the primary goal for policy. But in the area of human activity that lies between extremes of poverty and wealth, estimates of what sufficiency means will be relative as well as absolute. Moreover, the balance between what is judged to be essential or optional – 'needs' or 'wants' – changes with culture, time and technical possibility (Wilk 2002). The way in which an abundant, highly predictable supply of electricity has become a 'need' in Europe over the last hundred years is a case in point. But to make normative judgements on sufficiency, on how much is enough, is a risky business and not one that most of us enter into lightly. Energy services are valued not just for themselves (heat, light) but for the activities and social relationships that they make possible: they raise questions of justice and emotional ties as well as practicalities of supply and demand. It is easy to see why policymakers have shied away from sufficiency in favour of the concept of efficiency which, being a ratio rather than a quantity, can appear more politically neutral. (The choice of ratio is, of course, rarely neutral – see Princen 2005.)

However, the growth of concern about climate change and energy security now means that energy sufficiency is seen as something that warrants serious consideration, even by strong advocates of efficiency. The ECEEE response to the EU Efficiency Green Paper stated that energy efficiency remains a cost-effective way of improving the environmental impact of energy use, increasing security, improving competitiveness and providing affordable services. However, the response added that the EU needs to 'look beyond technical energy efficiency measures and address the challenging issue of curbing consumer demand for energy services in a politically acceptable fashion' in the longer term. This is essentially an acceptance that energy users in the EU, as a whole, have gone beyond a sufficient level of energy services, even if many individuals have not. It also implies a need to recognise limits and to establish acceptable minimum standards for energy services.

The arguments for bringing sufficiency into energy research and policy formulation are not new. It is a long time since it became clear that, however impressive individual efficiency gains may be, they are more than offset by increases in overall demand that flow from political systems, infrastructures and patterns of living (for example, see Norgaard 1995; Wilhite and Norgaard 2003; Princen 2005). This paper is an attempt to build on some of the earlier work and to set out some ways in which policy based on sufficiency might be shaped. First, it considers energy sufficiency as a concept and how it relates to efficiency and ecological carrying capacity.

## Energy sufficiency – some definitions and issues

The sufficiency issues that are most often raised in relation to energy are climate change, fuel security and equity. Use of which fuels, at what rates of consumption, will be enough to prevent dangerous climate change – where are the safe limits? Is there energy security of supply at individual or national level? Do the poorest members of a society have access to the energy services they need for health, comfort and participation? Do others have access to more energy services than are consistent with a sustainable society?

These questions indicate at least three ways of looking at energy sufficiency. As a concept, it could be broken down into carbon sufficiency (climate), energy consumption sufficiency (security) and energy service sufficiency (quality of life and equity). Ecological sufficiency lies beyond all three: do energy services for humans threaten the ability of the planet to support its human population while maintaining enough biodiversity for healthy ecosystems? This is a framework within which we are thinking not only of the impact of fossil fuel combustion, but also the impacts of radioactive waste, of land set aside for growing biofuels, rivers dammed for hydroelectricity and other consequences of the continually growing demand for both primary fuel and electricity. Timescales for environmental impacts vary from seconds (a dam bursts) to millennia or even eternity (decay time for radioactive waste, species extinction).

The range of ecological footprints[1] for individuals between and within nations is massive (Wackernagel and Rees, 1996), while the estimated annual carbon emissions from the most and least frugal individuals in a single nation can also differ widely, specially when air travel is taken into account (e.g. Fawcett 2005). Such analyses show how inequitable our consumption is. Some countries may appear to live within their means, if their ecological footprints are compared with national incomes or the estimated carrying capacity of their lands (Hammond, 2005). But in a world with globalised trade, resource bases may be far broader than national boundaries indicate. Importing manufactured goods effectively exports the carbon and climate impact of producing them to the exporting country.

If overall carrying capacity of the planet is the ultimate framework for policy, the Global Commons Institute's 'Contraction and Convergence' is the nearest we have to an ideal framework for carbon sufficiency. It is based on reduction of emissions in order not to exceed the estimated maximum safe concentration of carbon in the atmosphere and aims at equal per capita emissions in the long term (Meyer 2000). There are of course uncertainties in estimating what the maximum safe concentration is and how it might be achieved: many carbon stocks and flows, for example those in marine ecosystems, cannot be measured accurately. Neither can the effects of carbon offsetting and emissions trading be predicted with any great confidence (Lohmann 2005). We are left with quantitative uncertainties at international and national level, even when attempting to use the carbon reduction systems that are most widely adopted. Given the likely consequences of runaway climate change, extreme caution is the sane response to the challenge of setting a maximum absolute concentration. Both contraction and convergence imply massive changes to the way in which life is organised in the more carbon-profligate nations. Meeting the Kyoto requirements – even if that were actually happening – would only be a modest step in this direction.

Where climate sufficiency is concerned, the main questions are of the type, 'How much fossil fuel can we burn without devastating climate change? How much deforestation and meat-rearing can the planet afford? How much rice paddy?' Energy consumption sufficiency involves slightly more localised questions: 'How many months' worth of gas have we in storage? To what extent can wind energy make us self-sufficient in electricity generation? How much land, if any, should be set aside for growing, processing and storing biofuels?' these questions are

1. The Ecological Footprint is a measure of the 'load' imposed by a given human population on nature. It represents the land area necessary to sustain current levels of resource consumption and waste discharge by that population.

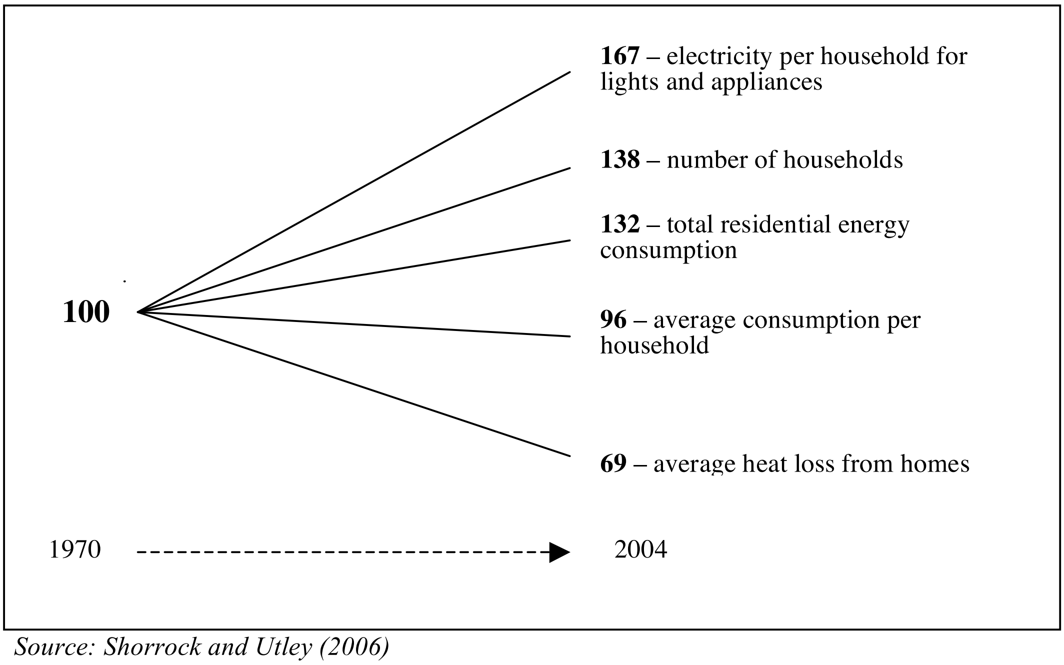


*Figure 1: Indices relating to residential energy consumption in Great Britain, 1970 – 2004*

well beyond the scope of this paper but are included to serve as a reminder of the context for the main topic, which is energy service sufficiency.

#### Energy service sufficiency

The demand for energy services determines what quantities of energy are used, and at what rate. In policy terms, managing energy service choices poses questions that are as critical as managing energy supplies. For example, what could be done to bring average household electricity demand down to 1 500 kWh per year while keeping householders content with the level of service? This may sound like an efficiency question, but in an economy where new appliances are continually being developed and marketed, it is also a sufficiency question. There are also questions of access to services: which need to be delivered on an individual basis and which may be shared? And questions of health, comfort and convenience: is a cold-season average indoor temperature of 18°C sufficient and if so, what does that mean in terms of design? Does a four-storey building need a lift that can be routinely used by able-bodied people?

Energy service sufficiency, then, takes us some way beyond energy efficiency. Efficiency has held out the promise of 'win, win, win': benefit to individuals, the economy and the environment through the adoption of improved technology, but efficiency gains have continually been matched or overtaken by population growth, increased demand for energy services and reductions in household size. Along with any improvements in energy-conserving behaviour, efficiency measures may be mitigating the impact of increased demand, but there is little sign that they are achieving more. In Great Britain, for example, overall energy consumption by households has risen by over 30 % in the past 30 years, although the average consumption per household has fallen slightly over that period. National energy demand figures are not coming down and the carbon gains of the 1990s (largely a result of the change from coal to gas as a generation fuel) are in danger of being lost. Improvements in insulation, in heating systems and in the energy efficiency of appliances have not managed to keep pace with the growth in number of households, the rise in average indoor temperatures, the proportion of each home that is heated and the increase in numbers of lights and appliances (see Figure 1). It is worth noting that incomes have been rising more rapidly than the cost of fuel for at least a generation: the proportion of income spent on fuel, light and power by the average household fell from 5.9 % in 1981 to 2.8 % in 2003 (Shorrock and Utley 2006).

In Europe, as in many other parts of the world, gains in technological energy efficiency have been more than offset by increasingly consumptive ways of life and political systems that aim for economic growth as measured in Gross Domestic Product. Some gains in national energy efficiency may be made by concentrating more on public sector development and on increasing 'capability' rather than individual average wealth, but even these are limited (Norgaard 1995; Sen 1999). Energy economics is rooted in assumptions about sufficiency, which in turn are influenced by background and values. For example, Verbruggen (2003) notes the tendency in the OECD to keep electricity budgets limited to some particular proportion of GDP. Why that particular figure? It is as though 'industries, households, institutions, governments etc. allow spillage of energy when the budget share is far lower than the number they are used to.' Yet energy crises show what can be achieved when sudden power shortages impose a ceiling on consumption and these perceptions are challenged. Experience of electricity shortages in Brazil, California, Ontario, Norway and elsewhere shows that savings of up to 20 % can be achieved and sustained for several months; sometimes with longer-lasting impacts as investments in more efficient technology and changed behaviour are adopted and maintained (Meier 2006).

We therefore have to look more widely and more deeply for possible solutions, asking how to translate global carrying capacity and any global ceiling on emissions into what can be achieved in terms of technologies, skills, expectations, econom-

**Table 1: Efficiency and sufficiency considerations for three energy services**

| Energy service | Energy efficiency considerations | Energy sufficiency considerations |
|---|---|---|
| Road transport | Miles per gallon / litres per km | Whether to travel; how much to travel; mode of travel |
| Indoor space heating | kWh delivered energy / m2 of floor area | Quantity of living space; household size; acceptable temperatures |
| Food chilling | kWh delivered energy / m3 of chilled space | Whether mechanical chilling is needed at all; quantity of chilled space |

ic and political systems. In particular, we have to doubt the notion that incremental changes in efficiency and behaviour can be effective enough to give us sustainable energy systems *on their own*, however strongly we might believe in the potential cumulative effects of incremental change (Darby 2005). For example, an income growth rate of as little as 2 % per year has been estimated to be enough to outpace savings in energy and carbon from the sort of modifications in lifestyle advocated by the Swedish Environmental Protection Agency, in the absence of any restrictions on consumption (Alfredsson 2004).

At the level of the individual or household, personal carbon allowances (PCAs) for direct fossil fuel use offer one route to limiting demand (e.g. Fawcett 2005). These could complement 'upstream' cap-and-trade schemes such as the EU-Emissions Trading Scheme. They offer a rapid method of awareness-raising, relative certainty of reaching a given level of emissions and relative equity between individuals. They also allow for personal choice in the matter of whether, how and where to 'spend' or trade the carbon allowance. PCAs represent a more radical step than lifestyle changes carried out without any 'consumption ceilings' in place. But they raise questions of how much people are prepared to accept (or even welcome) a given level of consumption as 'enough' and how much tolerance there will be of the lowering of carbon caps. Table 1 indicates how energy sufficiency considerations are more contentious than energy efficiency issues, by their nature.

To summarise: energy sufficiency can be considered in relation to climate constraints, energy security of supply and energy services, all within the framework of the carrying capacity of the planet. The emphasis of this paper is on energy services. Considered as a quantitative proposition, sufficiency of energy services is complex and involves normative decisions on how much is enough, whether these are based on scientific or intuitive judgements. But sufficiency and insufficiency are not experienced only as absolutes. They are also relative concepts, and this relativity is a major driver of growth in energy demand. Sufficiency is not just about the quantities of life, but about qualities: life as it is experienced in an interlocking set of social and political interactions.

## ENERGY EFFICIENCY AND SUFFICIENCY IN PRACTICE – EXAMPLES FROM RESEARCH INTO UK BUILDINGS

The starting point for this paper has been the experience of working on scenarios for energy use in buildings over the coming half-century, along with its associated carbon emissions (Boardman et al. 2005; Palmer et al. 2006). The most recent has been the *Building Market Transformation* project, an inquiry into policy and market framework options with the aim of halving carbon emissions from UK buildings by 2030. It involves the development and use of energy and carbon models of the UK building stock (Hinnells 2006). The project is interdisciplinary, exploring behavioural, social, institutional, legal and economic factors along with technical possibilities and trends. It builds on findings and recommendations from previous projects in relation to sufficiency that can be summarised as follows:

- Doing nothing is not an option – continuation of current energy demand and supply trajectories will give minimal reductions in carbon.
- There has been insufficient emphasis on reducing consumption. Reaching the ambitious carbon emission targets set by the UK government means going beyond efficiency, setting some upper limit on the demand for energy services.
- Various energy efficiency policies, such as grants, incentives and minimum standards, have been shown to give savings at a low cost but have not been used to full effect [not least because of the liberalisation of energy markets].
- Trends which may work against reducing overall consumption, eg increasing size and ownership of appliances, must be slowed or reversed (see Boardman 2006; Harris et al 2006).
- Policy needs to address the issues of which products come to market and 'education for sufficiency', so that demand may be reduced without losing quality of life.
- Bringing about socio-technical change towards greater sustainability requires a mix of policies, such as standards, grants and incentives.
- More perceptive schemes are required that recognise energy services as elements of day-to-day living rather than relying on technical determinism or economic rationality.

Table 2 gives extracts from possible scenarios to demonstrate some aspects of a model where sufficiency becomes relevant: internal temperatures, the pace of change in space heating demand, hot water demand and consumption by lights and appliances. Where will demand saturate? How much is going to be 'enough'?

These are relatively straightforward considerations, but they raise many questions, for example about future market penetration of hot tubs and monsoon showers, the situation of those on the lowest incomes and the likely effectiveness of personal car-

**Table 2: Some assumptions from three possible scenarios for the future of UK housing**

| | Scenario A (emissions from housing continue to rise until around 2035) | Scenario B (emissions in 2050 are 44% of those in 1996) | Scenario C (emissions in 2050 are 25% of those in 1996) |
|---|---|---|---|
| Headline approach | Current policy and incremental technical change | Aim for 60% carbon reduction by 2050 | Aim for 75% carbon reduction by 2050 |
| Internal temperatures | Saturate at 23°C | Saturate at 22°C | Saturate at 21°C |
| Space heating demand | Once internal temperatures are seen as sufficient, improvements in efficiency are taken as reductions in consumption | Demand decreases more quickly due to a faster rate of improvements and lower internal temperatures | Demand decreases more rapidly and efficiency improvements go further (eg more external wall insulation) |
| Hot water demand | Increases in line with current trends to 28% higher per person than current levels by 2050 | Water use increases in line with current trends to 2020 and saturates at 14% higher per person than current levels | Water use increases in line with current trends, saturating at 8% higher per person than current levels |
| Energy consumption by lights and appliances | Increases due to higher income (more ownership of appliances).<br>New energy-intensive products emerge, including cooling and more outdoor products (eg hot-tubs, patio heaters, heated swimming pools) | Decreases through improvements in efficiency via significant policy intervention as well as fuel switching | Decreases further through greater improvements in efficiency via policy intervention and fuel switching. Also through switching off, avoiding frost-free cold appliances, patio heaters etc. |

Based on Palmer et al (2006)

bon allowances or major change in energy pricing. The answers will depend a good deal on what comes to be associated with reductions in the levels of energy service: what the qualities of a more sustainable, low-energy-service-demand society are.

### ENERGY SERVICE SUFFICIENCY AS A QUALITATIVE CONCEPT

Individuals will tend to have strong and differing views on what levels of energy services are sufficient, based on their life experiences. The first President Bush's statement that 'the American way of life is non-negotiable', made at the Rio Earth summit, is only one notorious example of a common mindset. Everyone finds their own level of sufficiency (way of life), if they are fortunate enough to have room for manoeuvre, and will be inclined to defend it. For energy service sufficiency to be sustainable in wealthy societies with democratic institutions, it needs to be worth voting for ('as good as a feast'), as well as staying within the limits set by climate or security considerations. Three extended case-studies of the development of sufficiency as a basis for living are given by Princen in his book, *The logic of sufficiency* (2005). They describe a series of political decisions to safeguard a way of life from the logic of short-term efficiency, because it was a way of life that offered satisfaction and a future to the individuals and communities involved. Princen concludes that

> *The sufficiency principle, or something close to it, is likely to emerge … because it meets three conditions. One, it exists [already]… second, it is terribly logical [involving incremental testing and adaptation rather than efficiency ratios or cost-benefit analyses]… third, sufficiency is commensurate with biophysical conditions and long-term security. Unlike the efficiency principle which, as practised, fits frontier exploration and expansion, sufficiency goes straight to the … impossibility of ever-increasing human throughput…* (pp357-8).

Questions of sufficiency are becoming common in daily life already. We have abundant evidence that satisfaction with life does not rise in proportion with income or consumption, *once basic needs have been met*. The association between average 'happiness' or life-satisfaction and national per capita income breaks down once a threshold has been reached; and life satisfaction relies in any case on many factors apart from income (Layard 2003). Data from UK national accounts and life-satisfaction data from Veenhoven (2004) have been used to demonstrate that 'in spite of being three times better off economically than our grandparents [in real monetary terms], measures of people's subjective well-being show little change' (Jackson 2005. There are also well-recognised signs that successful pursuit of economic growth has personal as well as ecological costs. For example, the number of people claiming incapacity benefit because of mental illness has reached 1.1 m in UK. This is roughly 3 % of those of working age, to say nothing of increased levels of mental distress among children and adolescents. The incapacity includes drug and alcohol problems, stress, depression and eating disorders. The number of people claiming benefit in the UK because of stress has almost doubled over 10 years (BBC News 1.2.07). When life expectancy and per capita GNP are compared in the 25 richest countries of the world (as measured by per capita GNP), a slight negative correlation is found between the two. Explaining such figures is of course extremely difficult, but factors such as crime, relative disadvantage, social disruption and all the associated fears and tensions seem likely candidates (Marmot and Wilkinson 2001).

## Incorporating sufficiency into policy

The questions of where the numerical boundaries of sufficiency are drawn are crucial for policy. Where energy is concerned, these include: How much carbon is too much? What level of energy services is an acceptable minimum? But there are also issues relating to quality and durability. Developing energy sufficiency policy in 'western' countries requires continual monitoring, adjustment and negotiation. It has to involve recognition of ecological limits and the urgent need to reduce carbon emissions in particular, but also a vision of the type of changes that would move us in the right direction and still yield social and personal benefits. This means some broadening of the scope of household, business and public sector decisions – only a small proportion of decisions with energy implications are made with energy in mind (eg Weber 2000), and vice versa. It need not be this way. For example, the impacts of energy policy on health could be taken into account as a matter of course, not as an occasional add-on. The Treaty of Rome includes the principle that public health consequences should be considered for all decisions made in public life (Lean et al 2006), and it is increasingly desirable to design buildings and transport systems in such as way as to improve health chances (Norgaard 2005).

Below, I outline three areas for policy that could have substantial effects on demand for energy services. They relate to use of time, livelihoods and the credibility of policy.

### TIME

One of the most striking aspects of 'traditional' societies [i.e., with their roots in pre-modern practices] is their reliance on cycles of happenings. For example, regular rest-days and occasional holy days or feast days are found all over the world in some form or another. These serve to protect workers from exhaustion and to give opportunities for rest, reflection and celebration. On a longer timescale, the practice of letting land lie fallow gives the land a chance to recover fertility, a need that is often met now overcome by the 'efficient' but less sustainable practice of adding manufactured fertiliser with its associated energy costs. The concept of cyclical rest periods has an ecological as well as a social dimension. Losing sight of the importance of rest, in a 24/7 society, means that demand for energy services inevitably rises.

It is common enough to find energy policy debates on possible efficiency gains through technology transfer from industrial and post-industrial economies to more traditional societies. It is less common to recognise that traditional societies may have something to offer in terms of energy conservation. They are more likely to be romanticised than to be taken seriously. Sometimes, though, the gulf between tradition and modernity is bridgeable. Here is some advice to American visitors renting apartments in Italy, with some policy-relevant points to make:

> *'Many Americans … tolerate a narrow indoor temperature range, about 65 to 75°F, and are willing to pay the relatively modest cost to keep their homes within that range. Not so in Italy, where in the winter, Italians put on a sweater or two and warm slippers in order to tolerate 60°F. Summertime air-conditioning is a relatively new phenomenon in homes and even in many offices. The traditional solution is to go to the seaside or the mountains when it gets hot. Italians have* ***liberal vacation policies****, so many can spend the month of August staying cool. When you travel to Italy, be prepared to either* ***pay rather dearly*** *for a comfortable temperature in your rental apartment …, or to conserve energy the way the Italians do. Even if you don't exercise all of the energy saving options, consider that your Italian neighbors are doing so and this is an insight into how they live their daily lives ...* ***Schedules and buildings in Italy are designed*** *for the warmer climate. The afternoon siesta allows you to sleep through the heat of the day. High ceilings, large windows, French doors and thick walls all play a role in increasing comfort ... Thick walls insulate, trapping cool air inside. And windows and doors allow you to invite the beautiful climate indoors... And, of course, you can turn off lights when you leave a room, turn off the television when not watching…'* (Byrne 2005, my emphases)

The writer does her best to make the change appear inviting – you can sample the Italian way of life and 'invite the beautiful climate indoors' – but is aware that she may be asking too much of some of her readers as they make their individual choices. In broader terms, there is also a tension between business interests in expanding indoor climate control and the Italian energy infrastructures and social preferences, geared to a lower-impact way of life. Policy support for one side or the other, on what can be fundamental lifestyle issues, can make a substantial difference to energy demand. It is crucial to recognise that social and employment practices are also energy issues (and vice versa.

### LIVELIHOODS

Changing the nature of livelihoods perhaps poses the greatest opportunity and the greatest obstacle to change. Moving towards sufficiency means changing the nature of a great deal of the work we do and how it is rewarded and this will only be acceptable if the outcome includes fuller employment, greater satisfaction with working conditions and realistic expectations of a livelihood for young people. A shift in emphasis from labour productivity to resource productivity would lessen the energy intensity of a society (Levett 2004) but it clearly involves rethinking much of the received wisdom on competitiveness and the operation of markets. There is huge scope for labour-intensive refurbishment of buildings and their contents, and for manufacturing items to higher specifications: both make sense in a society based on sufficiency principles. A focus on livelihoods is partly a question of manufacture and repair of buildings and artefacts for the long term, partly a question of training, skill, variety and satisfaction from work. Scenarios with the end-point being (for example) 'full and rewarding employment' could be designed and tested to test their possible effects on demand for energy services and on carbon emissions.

### CREDIBILITY

Credibility involves seeing as much as possible of the whole picture for energy services: where they come from, how they are used and what the impacts are. Sufficiency requires a solid evidence base that is widely trusted and used at many levels, such as in-use performance monitoring for buildings and vehicles, controls that are accurate and easily readable, accessible websites, informative bills and metering displays, and a common, user-friendly language for discussing energy as a routine part of life.

**Table 3: Policy areas and possible applications**

| Policy area | Appliances | Buildings | Social, infrastructural, educational and policy support |
|---|---|---|---|
| Regulation | Minimum standards. Permission to manufacture, ie restrictions on profligate appliances | Development of planning and building regulations. | Metering standards. Incentives and training to improve building quality. Monitoring and enforcement of regulations |
| Information | Labelling based on tests in real-life situations and on absolute consumption (not efficiency) | Labelling for point of sale/lease, based on in-use performance | Informative displays and bills – accessible 'reality checks' |
| Indoor climate controls | Improved design of controls with easy manual override | Improved design of heating/cooling controls with energy-saving default settings and easy manual override | A control 'script' that promotes literacy – a common language |
| Pricing | Taxing /pricing to promote efficient low-consuming products | Taxing / pricing to promote low-consumption buildings | Progressive tariffs and /or taxation |
| Allowances/rationing | Personal carbon allowances | Personal carbon allowances; load limits | Load limits for neighbourhoods/ 'islands'; information on consumption in relation to the limits |
| Mobility and health | Reduction in remote control | Design for mobility and activity | Good provision for cyclists and pedestrians; restrictions on parking. 'Carbon coaching' to support lower-energy living. |
| Livelihoods / jobs | Training in appliance repair and recycling | Design for durability. Training in refurbishment and recycling | Taxation to favour jobs and discourage consumption of fuel and other resources. |
| Appropriate scale/ subsidiarity | International agreements on standards; national compliance; locally-sourced goods | Careful sourcing of materials. Refurbishment rather than replacement. Trusted local building inspectors. Community heating. | Mixed neighbourhood developments (housing + employment) for local jobs. Attractive neighbourhoods, local food production, car-sharing, integrated transport planning |
| Durability | Design for durable and/or recycled goods. Life-time consumption labelling | Durable and/or recycled material. | Mixed land use for accessible neighbourhoods; |
| Use of time | Light and movement sensors for lighting; timers for all water heaters with economical default settings and easy manual override | Heating/cooling timers with economical default settings and easy manual override | Shorter working hours and opening hours; public holidays and rest days supported by law. Funding for accessible music, drama, dance and sport |
| Consumption monitoring and evaluation | Feedback on appliance consumption, in real time | Feedback on consumption and building-integrated generation, in real time and historically, to show trends | Feedback on supply at local and broader levels; availability of credible comparative feedback |

How might all this look, in terms of developing practice? Table 3 gives an outline of policy applications that can be introduced in relation to energy service sufficiency in buildings, along with some that are already under way. These would combine efficient technologies with sufficient services and the support needed for both.

## Summary

Policies for energy efficiency are not enough to achieve the huge reductions in absolute energy demand that are needed to offer some prospect of avoiding runaway climate change. Workable ways of incorporating sufficiency principles into policy in the wealthy nations of the world are needed, and needed urgently.

Exploration of the idea of sufficiency is not new and this paper has referred to a small sample of the literature in support of the need to move beyond efficiency. It shows how sufficiency is both a quantitative and qualitative concept. Where energy services are concerned, it involves setting minimum standards for services as well as for the technology that provides them, as well as maximum permissible environmental impacts. The paper also demonstrates how increased levels of material well-being, with the associated energy services, have not necessarily translated into increased quality of life and can jeopardise human welfare and biodiversity. Because ecosystems are dynamic, policies need to be flexible enough to adapt to ecological signals over time and to cope with uncertainty. Radical change is needed in the fuel-consuming habits of the wealthiest nations and individuals but an emphasis on efficiency in policymaking is too narrow to bring about such change. To date it has managed only to slow down increases in demand, not to bring about durable demand reduction.

A summary of a modelling exercise for the built environment showed how efficiency (technology, economics) and sufficiency (level of service, infrastructure) belong together in developing future policy. Energy efficiency can be seen to be 'nested' within energy sufficiency, which in turn belongs within the concept of ecological carrying capacity.

Qualitative indicators need to be brought into play alongside quantitative measures of sufficiency. Policies stand a far greater chance of being sustainable if they are seen to improve or maintain quality of life; and the development of better indicators for this is under way and still vital. Three factors in energy service sufficiency and sustainability were picked out as particularly significant and ripe for inclusion in energy policy: use of time, livelihoods and credibility.

To adopt sufficiency as a force in policy is to recognise boundaries to a social order and to make normative judgements: so much consumption is enough; so much is too much. But the qualitative aspects of sufficiency open up the possibilities for policy in addressing the challenges that lie ahead. A focus on rewarding livelihoods and full employment rather than on labour productivity could transform patterns of energy use, however great the threat it poses to current patterns of work and income distribution. Sufficiency can also mean that people have an overview and an understanding of the processes of resource cycling, because these processes become more transparent and credible. Finally, sufficiency is not a fixed state. It requires change and movement, whether these be cyclical (rhythms of work and rest, 'ordinary' and festival time, abundance and scarcity) or linear: moving out of the 'carbon age' into one dominated by renewable resource management.

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