21

Lifestyles, Well-Being and Energy

Convening Lead Author (CLA)
Joyashree Roy (Jadavpur University, India)

Lead Authors (LA)
Anne-Maree Dowd (Commonwealth Scientific and Industrial Research Organisation, Australia)
Adrian Muller (University of Zurich & Swiss Federal Institute of Technology Zurich, Switzerland)
Shamik Pal (Institute of Engineering & Management, India)
Ndola Prata (University of California, Berkeley, USA)

Review Editor
Sylvie Lemmet (United Nations Environment Programme)

Contents

Executive Summary

One of the objectives of the Global Energy Assessment (GEA) is to assess the means through which the potential negative economic, social and environmental impacts from energy use can be mitigated or eliminated, either by increasing the efficiency of energy use or by switching to primary energy sources and carriers. A large set of factors influence ultimate energy use beyond those related to income and affluence. These include non-economic and non-technological drivers such as behavior, lifestyle, culture, religion and the desire for improved well-being.

This chapter focuses on these underlying drivers and explores how they could influence energy use and choice of energy sources while maintaining desired levels of affluence or income. It reviews the factors that determine how socio-economic indicators of affluence and other non-technological drivers may translate into demand for energy services (for definition of energy services, see Chapter 1) and at the interventions, policies and measures (such as taxes, infrastructure, building codes, and access to information) that could modify or change lifestyles and preferences.

In addition to the consumption of goods and services and their quality, the chapter also focuses on two elements of lifestyle choices that have significant implications for energy use: diet and mobility (household energy use, another key element, is discussed in Chapter 10 while transport is discussed in Chapter 9). In general, income is often a common driver across these choices. However, modest decoupling between income and energy use can be observed at the aggregate level in many jurisdictions and time periods, by which energy use increases at a lower rate than income. This can be observed for many industrial countries but may not yield the same outcome in most developing countries for several reasons, especially when total energy accounts for significantly inefficient non-commercial energy use. It is therefore useful to look beyond income alone and explore underlying lifestyle choices and their energy implications. Behavioral change requires both knowledge contributions to change attitudes and policy implementation to provide incentives for action.

Concepts of well-being have important implications on how energy services demand and energy use are assessed. Applications of economics conventionally assume that knowledge about resource scarcity is reasonably good and reasonably widely understood. More complex notions of well-being are better able to take other factors into account even in situations of decreasing energy services.

Notions of well-being that are based only on material consumption of goods and services implicitly assume that resources needed for production of these goods and services are abundant and that either a technology can be invented to make them more productive or that new energy resources can always be found to replace depleting resources. This underlying assumption of high substitutability between different resources fails to capture more complex, multidimensional notions and differing characteristics of energy services that may actually hinder substitutability. This is of particular importance when addressing basic needs for a decent good life and the energy services demand to meet those. The assumption of substitutability is important, as wrong assumptions about it can, for example, lead to overestimations of projected well-being when the aggregate quantity of energy use is considered but not its qualitative composition.

The potential for increased sustainability that lies in strong decoupling of well-being from material consumption can be captured by notions of well-being that are not based on material consumption alone, as reflected in the gross domestic product (GDP) per capita indicator. This offers new policy options of potentially high leverage. A reduction in energy services demand does not necessarily reduce well-being and lifestyle changes can deliver some win-win options (e.g., walking and cycling) that reduce demand for energy services with the same or even improved levels of personal health and social well-being.

Life style changes are an effective and powerful approach to addressing sustainability issues, as they can provide multiple benefits like improved health, low fossil fuel based mobility, lower emissions, and nutrition, without reducing socio-economic status.

21.1 Introduction

A popular framework that can be used to understand the link between energy systems to emissions and the environment is the I=PAT framework detailed in equation below:

Impact (e.g., from CO_2 emissions) = Population × Affluence (GDP/capita) × Technology (kWh/GDP) × Emissions (e.g., from tCO_2/kWh)

Total energy use and its impact are magnified by population and affluence and are influenced by technology. They link emissions and environmental impacts from energy systems to the underlying drivers of population and affluence and the elements of energy systems – that is, the primary energy sources and supply-side and end-use conversion technologies required to meet demands for energy services (Ehrlich and Holdren, 1971; Hubacek et al., 2007).

In general, personal disposable income is often a common indicator for affluence and energy service demand. However, it can be observed that the link between income and energy use is weakening at the aggregate level in many jurisdictions and time periods. Weakening of the income-energy coupling means that energy use increases at a lower rate than income. While real global gross domestic product (GDP) increased by 1.6 times from 1990 to 2007, for example, total primary energy use increased by 1.4 times. The modest trend towards decoupling can be observed for many industrial countries but may not yield the same outcome in most developing countries for several reasons. It is therefore useful to look beyond income alone and explore underlying lifestyle choices and their energy implications. GEA is concerned with the means through which emissions and other negative impacts may be decoupled from affluence or income, either by increasing the efficiency of energy use or by switching to primary energy sources that have a reduced environmental footprint. Nevertheless, a large set of other factors influence ultimate energy use beyond these two key ones, including non-economic and non-technological drivers such as lifestyle, culture, religion, desire for improved well-being and behavior.

Conventional economic models assume that preferences are determined individually and do not change. This chapter focuses on the many underlying drivers of preference and explores how lifestyle choices can influence energy use while maintaining desired levels of well-being. It looks at the factors that determine how indicators of well-being and other non-technological drivers may translate into demand for energy services and at the interventions and policies that could modify or change lifestyles and preferences.

In addition, the chapter explores a more fundamental question of whether defining affluence in purely economic terms is an appropriate measure for well-being. Thus it explains the individual and social goals underlying energy use. To the extent that affluence or income is only one of the determinants of well-being, there may be further opportunities to decouple energy use from human well-being. The chapter includes a brief review of the emerging literature on well-being and on indicators and metrics that go beyond affluence in conceptualizing development. Thus, this chapter is about the potential for increased sustainability through changes in lifestyles and the resulting change in demand for energy services.

By focusing on consumers, a new perspective on energy system management is added that recognizes the importance of the psychological, sociological and cultural determinants of demand. Such an approach thus augments and complements the more common technological and conventional economic approaches used in the analysis of energy supply and end-use.

A focus on the consumption basket also allows the exploration of options for replacing one energy service with another. For example, in telecommuting the demand for mobility may be replaced by an increased use of electricity for information and communication appliances, perhaps leading to a reduced use of primary energy. In this view, the elements of the consumption basket of energy services are not independent, but their levels are assessed jointly based on relative costs and benefits given the prices, income, tastes and preferences, and social fabric within which a consumer functions.

21.2 Lifestyles and Energy Services Demand

Often the individual demand for energy services is expressed or assessed only at larger levels of aggregation, such as the household, community, or region. Converting to individual demand is only possible via averages (e.g., per capita average energy use to provide street lighting in a village). It is also clear that not all energy service use can be traced back to private individual consumption decisions (e.g., public/governmental provision of infrastructure services such as street lighting).

Consumer activities influencing directly the energy use (e.g., housing and private transport) account for more than 43.0% of total energy use (see Chapters 9 and 10, as well as Chapter 1, Table 1.2). Figure 21.1 shows the energy use of US citizens in 1997 for different energy services when accounted for from a life cycle perspective. Since many of the individual decisions will entail indirect energy uses, life cycle analysis can shed light on important use categories that are not directly accounted for or paid for by individuals. Figure 21.1 indicates consumer activities influencing directly energy use accounts for a lesser share in total energy compared to factors influencing indirectly the energy use. Housing operation uses the most energy among all consumer activities which is mainly contributed by the consumption of utilities (electricity/natural gas/fuel oil and other fuels/telephone, and water and other public services). For direct influences, personal travel is the most energy intensive, much of which is caused by short distance travel by automobiles and trucks.

Understanding the linkages between lifestyles and energy services demand offers insight into how changes in lifestyles may contribute to

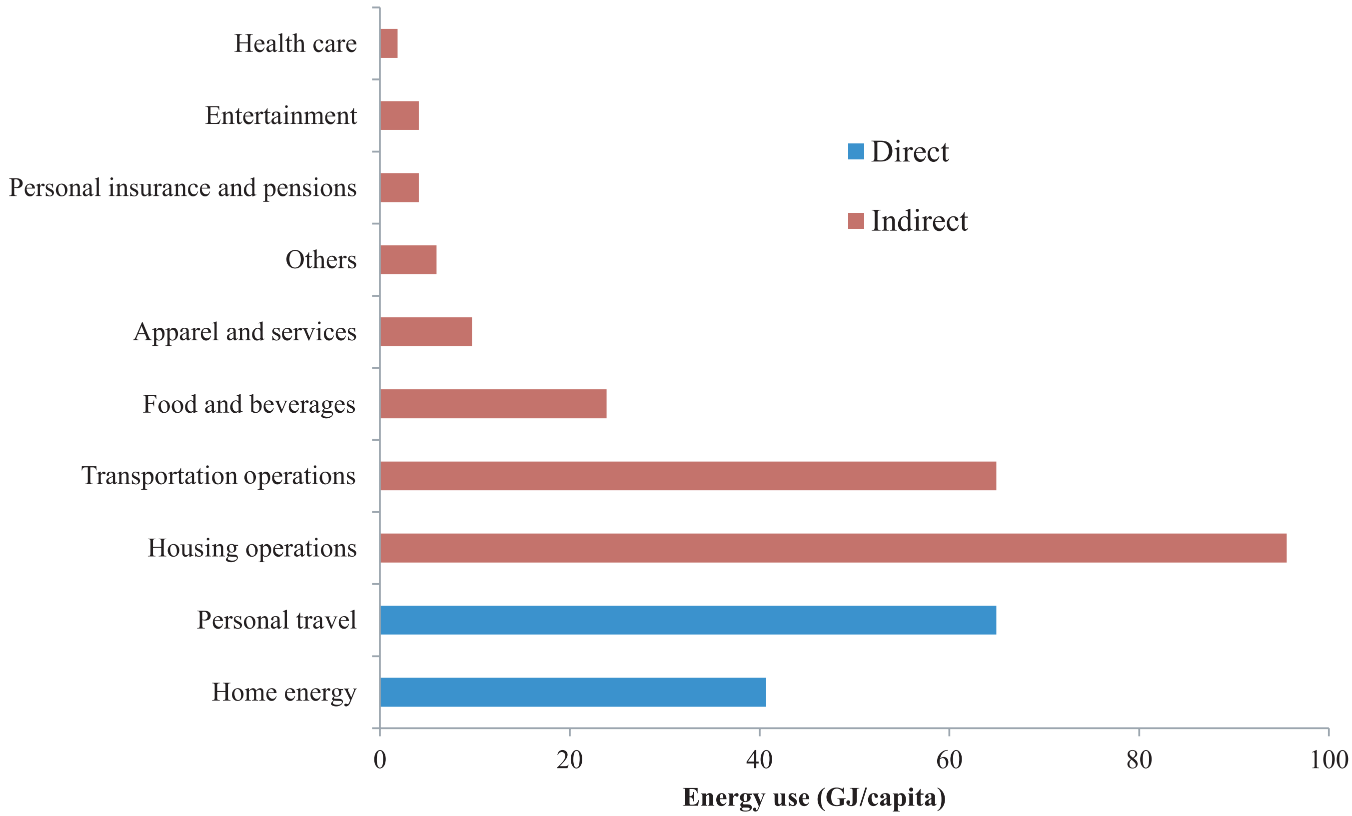

Figure 21.1 | Direct and indirect energy use by consumer activities in 1997. Source: Bin and Dowlatabadi, 2005.
Note: Home energy includes: space heating, other appliances and lighting, water heating, refrigeration and air conditioning. Transport operations include: vehicle purchases (net outlay) (cars and trucks, new/cars and trucks, used) gasoline and motor oil other vehicle expenses (vehicle finance charges, maintenance and repair, vehicle insurance, rent, lease, licenses, public transportation etc.). Housing operations include: shelter, utilities, and public services (e.g., electricity, natural gas, fuel oil and other fuels, telephone, water etc.) as well as housekeeping supplies, household furnishings and equipment (e.g., household textiles, furniture, floor coverings, major appliances, small appliances as well as miscellaneous houseware and household equipment). Personal travel includes: short and long distance travel by automobiles, trucks, air, etc.

reducing total energy use and is all the more relevant in today's internationally connected world through trade relations. Here, it is crucial to introduce the notion of well-being as the ultimate goal by which to judge supply-side or policy interventions in improving human well-being or sustaining a high level of well-being in a long-term, sustainable development context. Changes in lifestyles and energy services demand need to be assessed in relation to alternative concepts of well-being than those directly related to high economic attainments and spending. Referring to well-being also means addressing not only absolute reductions in energy services, which might be an issue for high-income consumers and regions, but also absolute increases in energy services, which are still necessary for a huge percentage of the population in developing countries.

Consider the case of private car mobility. The same level of the service (expressed as passenger-km per year or per capita km driven per year) may be associated with different levels of energy use, based on factors such as vehicle efficiency, age distribution of the vehicle stock, driving characteristics, and so on. Consequently, interventions that improve efficiency allow the reduction of energy use while maintaining the same level of consumption of the service.

From a policy perspective, however, it is not just the absolute level of the service that is important but rather the generation of utility from the consumption of the service or the production of goods and services where mobility serves as a factor input. Interventions that allow the same level of utility or welfare for reduced levels of mobility are also important from an energy and impact perspective. Such modifications of demand may often involve behavioral or lifestyle choices such as walking or cycling instead of driving for short shopping trips. At the same time, it is important to recognize that such choices may have benefits quite independent of their energy or environmental outcomes – for example, the positive effect on individual health due to increased physical activity. This example refers to industrial countries, however; the situation could be different in developing countries, where absolute levels of motorized personal mobility are very low and therefore an increase would clearly improve well-being.

Addressing changes in mobility services and technologies or in an energy carrier in a lifestyle context sharpens the vision for the full range of possible options for intervention, as the change in mobility and increase in well-being need not necessarily be based on private cars. Furthermore, an energy services and lifestyle approach emphasizes the fact that mobility can be framed differently, namely via "accessibility" of certain goods and services (see also Chapter 9), which further broadens the set of possible options for action to improve well-being, in particular if the need to gain access to these goods and services is a determinant of well-being.

Consumer energy services demand is determined by needs and preferences for multiple services, which in turn depend on, in addition to income level and prices, home country characteristics, dwelling area and type, job and leisure activities, diet preferences, cultural context, religion, etc. A certain lifestyle is characterized by a bundle of these determinants combined with a more or less explicitly framed worldview, a set of values and convictions, preferences, and behaviors. It is embedded in some social context of identity and meaning. Thus, lifestyle can be considered as an organizing concept, making explicit that human beings live a life well beyond the mono-dimensional life of an economic agent responding only to income and price variables.

The importance of characterizing lifestyles is brought out in studies by Christensen (1997) and Alfredsson (2004) of households in the United States and Sweden. Assuming floor area of the dwelling as a proxy for overall affluence levels, for families of the same size and with similar floor areas, Christensen (1997) showed the wide variation in final energy use due to choices on mobility, diet, and space heating. For example, people living near their workplace or commuting by public transport and with a dietary choice of less than the US-average amount of meat and using renewable energy-based heating systems could reduce energy use by 88% compared to those travelling long distance and eating meat more than average level, while using fossil fuel based systems. Diet and mobility choices matter not only for energy use, but also for disease burden and public health. Particular dietary choices, e.g., above average meat consumption, have been associated with higher incidence of many diseases (Mann, 2000; Fung et al., 2004; Walker et al., 2005; Caspari et al., 2009; Sinha et al., 2009). Findings from Edwards and Tsouros (2006) identify an ongoing decline in physical activity across all age groups during the past several decades. This is largely due to the mechanization of work and daily tasks, the increased use of cars, increases in sedentary work, the use of labor-saving devices, and an increase in leisure pursuits not involving physical activity (such as watching television and using a computer). Physical inactivity causes an estimated 600,000 deaths per year in Europe and leads to a loss of 5.3 million years of healthy life expectancy per year due to premature mortality and disability (Edwards and Tsouros, 2006).

The Swedish study (Alfredsson, 2004) also showed that dietary choice, mode of transport[1], fuel type, and appliance choice for indoor comfort – all changes in pattern of consumption – generally reduce energy usage though may not reduce level of energy use significantly. If energy use reduction of the full green consumption basket is taken, it turns out to be less than the added value of reductions that can be estimated from each of the green end-use-specific lifestyle changes. This is because some benefits of a partial greening of lifestyle (such as dietary choice) by end-use type is taken back by the rebound effect of an enhanced level of energy services (such as mobility) of another end-use activity or efficient mobility service may be taken back by changing lifestyle in favor of international tourism.[2] However, studies have shown that this take back effect is high in societies with more unmet demand (Roy, 2000).

Assessments of lifestyles often focus on consumption and leisure time activities and how they contribute to creating identity and meaning (Geißler, 2002). The concept of lifestyle is thus also studied in connection with "social class" and status (Wind and Green, 1974; Sobel, 1981). Social dimensions and individual lifestyles are not disjoint; lifestyles are partly the consequence of deliberate individual choices and partly determined by social contexts as well as physical and economic boundary conditions (Harrison and Davies, 1998). These lifestyle types may often be grouped along the two dimensions of "social status" (lower, middle, higher) and "basic values."

A large amount of literature assesses lifestyle as a matter of combining different activities defining consumption patterns without regard to values, convictions, and social context (Herendeen and Tanaka, 1976; Rees, 1995; Vringer and Blok, 1995; Daly, 1996; Duchin, 1998; Biesiot and Noorman, 1999; Perrels and Weber, 2000; Pachauri and Spreng, 2002; Lenzen et al., 2004; Cohen et al., 2005). There, lifestyle categories are, for example, defined by expenditure types (Minx et al., 2009) and or through correlation in a narrow operational sense between level and pattern of consumption and socioeconomic parameters such as age, sex, gender, education, occupation, or income.

Households are an important target group in any energy conservation discussions. A study involving over 300 households in the Netherlands (Benders et al., 2006) indicated that direct energy needs – energy for space heating, electricity, and motor fuel – along with indirect energy requirements, which is defined as that needed for production, distribution, and waste disposal of consumer goods and services (e.g., production of food), amounted to as much as 80% of total energy flows. But the relationship between affluence, household characteristics, and energy use is complex. Household energy use and embodied energy through consumption (building energy use aspects) are discussed in Chapter 10.

1 Tourism is growing rapidly in Sweden with very distant places being increasingly popular. A Swedish family's carbon budget is totally dominated by a trip to one of these distant places.

2 The rebound effect is discussed in detail in Chapter 22.

The remainder of this section describes in greater detail two other elements of lifestyle choices that have significant implications for energy use: diet and mobility.

21.2.1 Diet

Dietary choices and delivery systems can lead to considerable variations in energy service demand and resultant energy intensity of food baskets. In high income countries food accounts for 17–18% of indirect household energy use (Vringer and Blok, 1995; Reinders et al., 2003; Cohen et al., 2005).

While satisfying the nutritional needs of humans accounts for a significant portion of total primary energy demand, the individual energy components of the food supply chain that fall in each sector are relatively small, such as cooking and refrigeration (the most important energy end-uses in buildings related to satisfaction of nutritional needs, along with the provision of hot water), and represent only a few percent of building energy use. Food systems cross the boundaries of many sectors and thus affect many chapters in the GEA: buildings (Chapter 10), transport (Chapter 9), and industry (Chapter 8), as well as rural issues (Chapter 19). Therefore it is especially important to consider energy services related to nutrition. Dietary choices depend on habits but also reflect acquired tastes over time. So net benefits and costs assessment of a dietary choice will vary over time and will change with changing acquired tastes. This section examines the implication of dietary choices (including cooking) for total energy used for the provision of nutrition. In low per capita income countries as per capita income rises, consumers will shift some consumption away from lower value cereals to higher value livestock products. In developed countries, where incomes and livestock product consumption are already high, consumers are expected to make relatively small adjustments between food consumption groups with changes in income levels (Cranfield et al 1998).

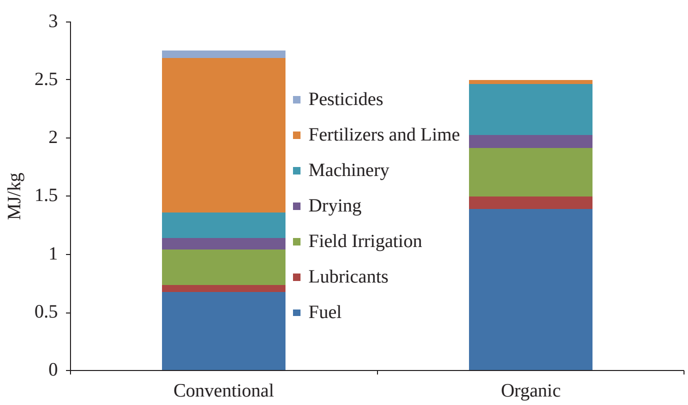

Figure 21.2 | Structure of energy inputs for conventional and organic farming systems. Source: Based on Jorgensen et al., 2005.

The total amount of energy required to provide human nutrition consists of the energy needed for agricultural production; land use and land cover change; the energy embodied in the raw food materials themselves and in the agrochemicals; the energy needed to transport the food components, water and equipment needed for food production; the industrial energy use related to food processing; and the energy used for refrigeration and cooking.

The embodied energy in the raw materials used for food directly correlates with the structure and nature of the daily diet. For instance, producing 1 kcal of grain and animal proteins requires about 2.2 kcal and 25.0 kcal of fossil energy, respectively (Pimentel et al., 2003). Thus the difference between the energy inputs for plant- and meat-based meals may exceed a factor of 10. Furthermore, the food produced by conventional agricultural methods requires a total higher energy input than organically produced food. Conventional agriculture production utilizes more overall energy than organic systems due to heavy reliance on energy intensive fertilizers, chemicals, and concentrated feed, which organic farmers forego (Ziesemer 2007). Figure 21.2 shows in some specific crops and practices in some countries in organic farming direct fossil fuel use might be higher because of relative high machine use for weeding and animal manure spreading compared to pesticides and synthetic fertilizers in conventional practices but overall energy use is less in organic farming. But in the same study (Jorgensen et al., 2005) it is shown indirect energy use is higher in conventional farming because of synthetic nitrogen fertilizer use. It is not only food production but also post-harvest practices and food delivery in which energy use needs to be examined. Both agricultural systems use separate but parallel systems, and only a few studies include data on packaging, delivery and so on. Studies (e.g., Bertilsson et al., 2008) have shown that choice of data, country context and their representation, accounting for energy use can misrepresent fuel use data across conventional and organic systems. A diet consisting mainly of locally produced, seasonal foodstuffs is significantly less energy-intensive than one based on "globalized" (and thus shipped) ingredients or produced in greenhouses. Thus an equally nutritious but plant-based diet using local, seasonal ingredients may require less total life cycle energy input than a meat-based diet using globally produced and not necessarily seasonal ingredients.

The literature on the impact of a dietary choices on energy and carbon footprint (such as Coley et al., 1998; Lenzen, 1998; Kramer et al., 1999; Carlsson-Kayama et al., 2003; Wahlander, 2004; Eshel and Martin, 2005; Baroni et al., 2006; Wrieden et al., 2007; Collins and Fairchild, 2007) focuses on the link between nutritional choices and energy use as well as ecological footprints of different diet types, mostly in industrialized countries. A key topic is the issue of meat consumption.

For many consumers, meat consumption is considered as a superior good – one that increases with rising income levels. People in

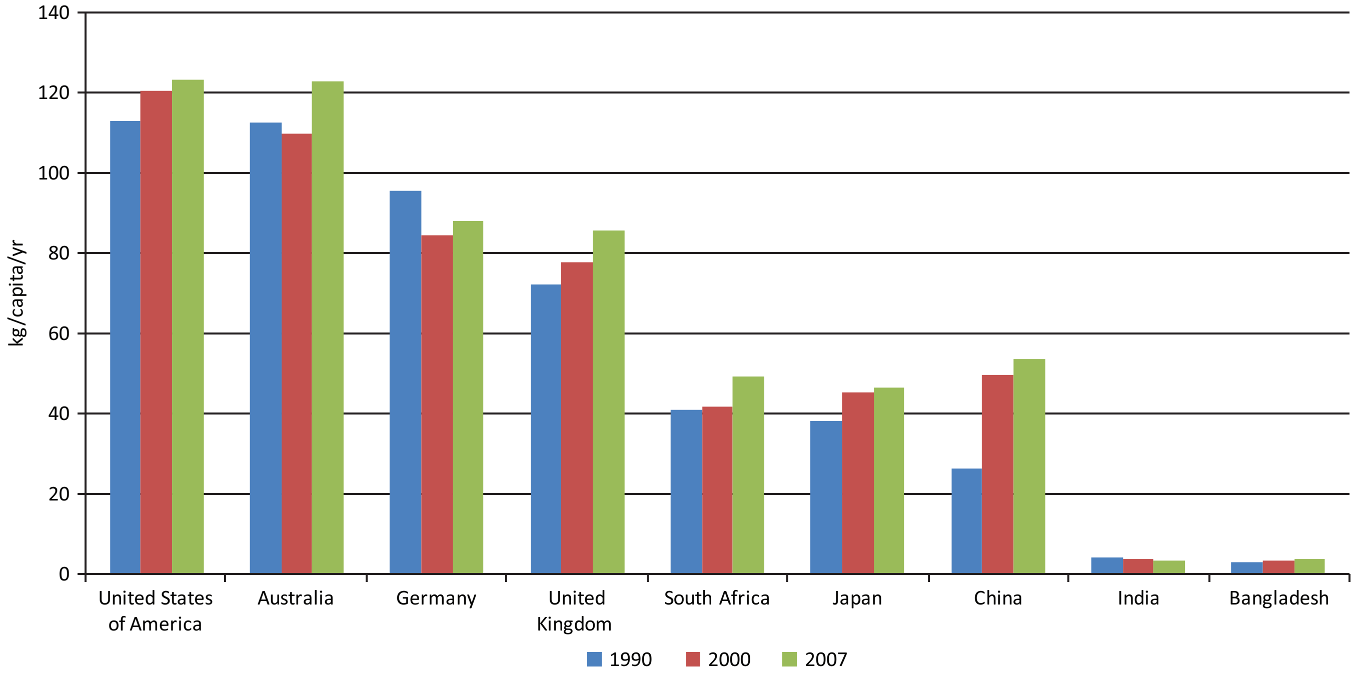

Figure 21.3 | Per capita meat consumption across regions. Source: Prepared using data from FAOSTAT, 2008.

low-income countries spend a greater portion of their budget on food, and when their income rises they increase their expenditures on different food items to a greater extent than people in wealthier countries, with the greatest increase being on higher-value food items such as dairy and meat (Regmi et al., 2001). The amount of food and foodstuffs that is not consumed but is thrown away or wasted through food preparation also increases with income, and this represents an increasing amount of embodied energy and other environmental pressures.

Population growth along with economic development has increased purchasing power, causing a demand not only for more food but also for different food varieties. Studies on human nutrition worldwide have indicated a nutrition transition toward more-affluent food consumption patterns (Gerbens-Leenes et al., 2010). Meat consumption is increasing globally, of which approximately 24% is beef. Beef consumption increases with income (Fiala, 2006). Per capita meat consumption varies widely across regions currently (see Figure 21.3) but is expected to rise with urbanization and income increases. FAO statistics show beef consumption has also the same pattern across regions. In China, while consumption change in proportion to income, change is lower for traditional pig meat consumption (0.15), for beef rate of change in consumption is more than the change in income (1.56) and for goat and poultry meat it is near proportional 0.88 to 1.05 (Masuda and Goldsmith, 2010). Proportional change would occur when value of ratio of change is equal to one i.e., rate of change in consumption is the same as rate of change in income. Urbanization and per capita income growth have contributed to these. In India a 1994 national food survey in 32 cities indicated that 74% of urban households were non-vegetarian and that meat consumption rose in 1980–90 at 4–8% (Landes et al., 2004). In Mexico, chicken consumption is expected to rise more than 64% in the next two decades. While household consumption of chicken meat for the higher-income group can be expected to rise by 0.18% for 1% change in total household expenditure, for the lowest ten percent of households arranged in order of expenditure the change in chicken meat can be as high as 1.65% for 1% change in total household expenditure (Salazar et al., 2005). Total meat consumption in the United States is the highest and, as in most of the world (except in Germany), has been growing at a steady rate (however, at lesser rate than, e.g., United Kingdom) for a number of years.

The specific energy use (SEU) in processed meat products is very high (Table 21.1). Ruminant meat production uses about 25 kg of plant protein to produce 1 kg protein as meat, whereas for pigs this relation is about 10 kg for 1 kg meat and for poultry is around 5 kg. This is in particular the case if animals are fed with concentrate feed and are not reared in pasture-based systems; however, the latter is an option for ruminants only but not for pigs and poultry (Smil, 2002). Over the past few decades, energy needs for transport, storage, and processing has increased, especially for meat products. A study in France, the United Kingdom, the Netherlands, and Germany indicated a significant increase (14–48%) in the energy use per tonne of product over the last 15 years (Ramírez et al., 2006).

Table 21.1 | Direct specific energy use and emissions for various processed meat products in select European countries.

Product	whole and chilled (MJ/t dress carcass weight)* SEU	whole and frozen (MJ/t dress carcass weight)* SEU	cut up, deboned, and chilled(MJ/t dress carcass weight)* SEU	cut up, deboned, and frozen (MJ/t dress carcass weight)* SEU	$kgCO_2$-eq/kg of meat type**
Beef, veal, and sheep	1390	2110	2146	2866	34.6–17.4
Pork	2093	3128	2849	3884	6.35
Poultry	3096	4258–5518	3852	5014–6274	4.57

Source: *Ramírez et al., 2006; ** Srivastava, 2008.

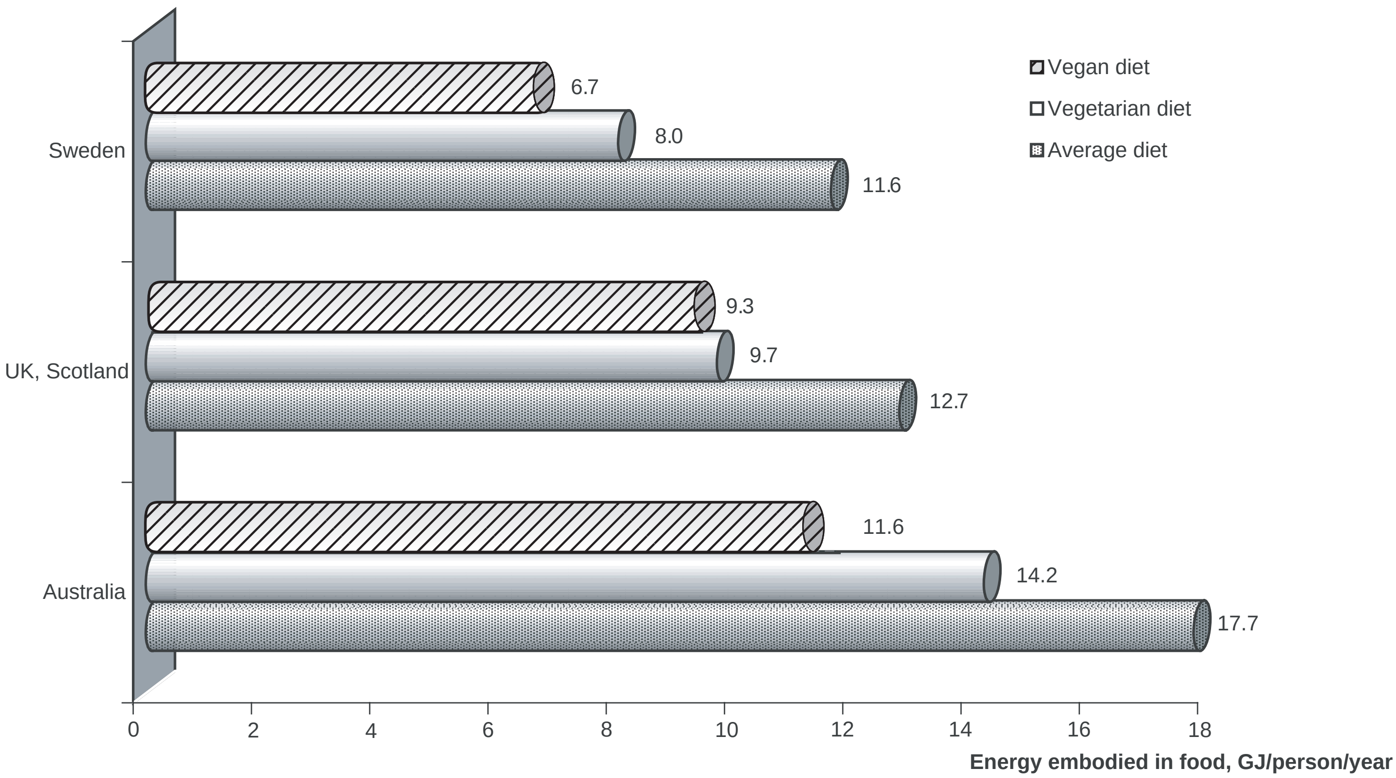

Figure 21.4 | Comparison of embodied energy in average, vegetarian, and vegan diets in Sweden (1999), Scotland (1995), and Australia (1994). Calories of fish, meat, and other animal products consumed in the average diets were replaced by a proportional increase in consumption of other food products in the vegetarian and vegan diets. Source: Coley et al., 1998; Lenzen, 1998; Wallen et al., 2004; Wrieden et al., 2007.

Figure 21.4 compares embodied energy in average, vegetarian, and vegan diets characterized with the same caloric value for Sweden, Scotland, and Australia. Embodied energy is sum total of energy use from cradle to grave of a product, i.e., energy used directly for production, transportation, marketing, as well as disposal and dismantling. There is a significant difference between energy inputs for these three diets. The difference between average and vegan diets equals 19.6 GJ/yr for a four-person family in Sweden, 24.4 GJ/yr for a similar family in Australia, and 13.8 GJ/yr in the United Kingdom – that is about 5.44 MWh/yr, 6.19 MWh/yr, and 3.02 MWh/yr respectively. These figures are similar to the average annual electricity use per household in these countries. However, the figure also attests that other determining factors that are related to the location may influence total nutritional energy use more than the dietary choice alone. For instance, a vegan diet in Australia is associated with as much life-cycle energy use as a standard Swedish diet.

The embodied transport energy in food is determined by shipping distances, transport mode, and vehicle efficiency (Saunders, 2008). With increased globalization, the length and complexity of food supply chains

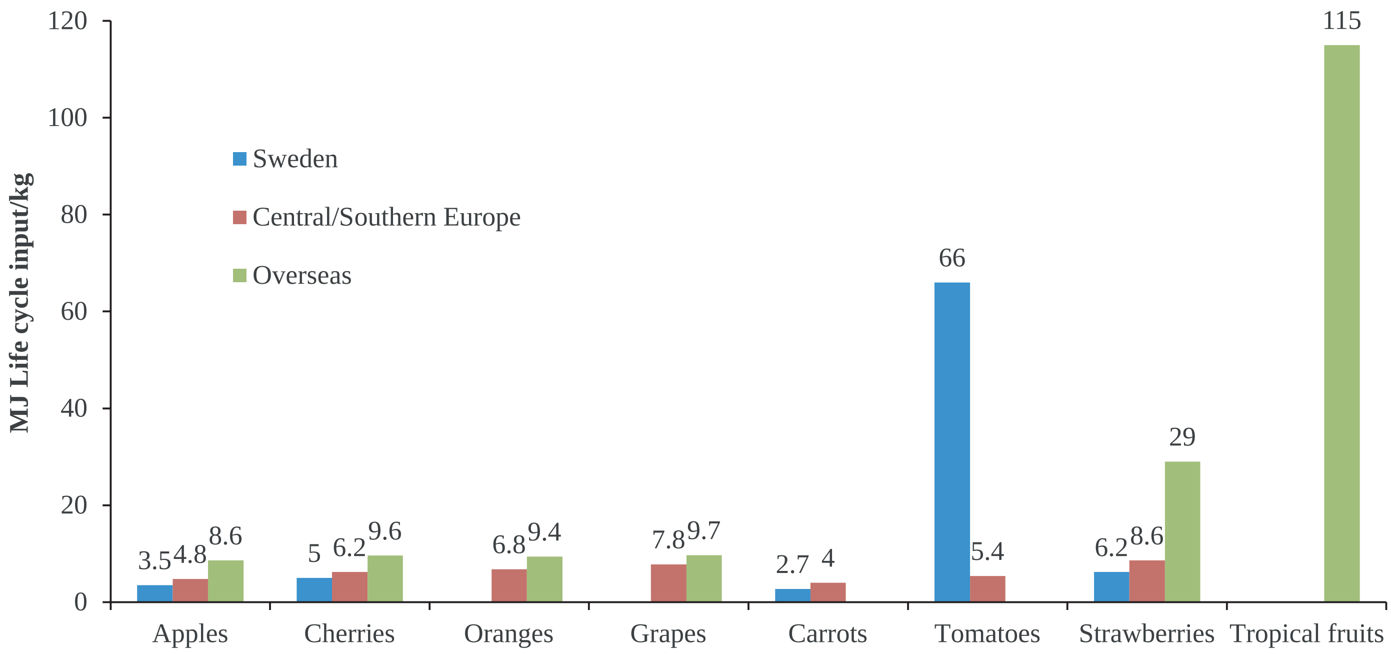

Figure 21.5 | Life-cycle energy inputs associated with local, regional, and overseas sources of food production for Sweden in 1999. Note: Tomatoes produced in Sweden were grown in a greenhouse while those in Southern Europe were open-grown; strawberries grown in the Middle East and tropical fruits were air-freighted. Source: Carlsson-Kanyama et al., 2003, in Saunders, 2008.

keeps growing (EC, 1999; Garnett, 2003), which results in increasing "food miles." Comparison with Table 21.1 suggests that two-thirds of total energy use is indirect.

Figure 21.5 compares the life-cycle energy input of fresh vegetable and fruits produced locally (in Sweden), regionally (in the European Union), and overseas. The figure illustrates that locally produced food is less energy-intensive than food shipped from a distance: the life-cycle energy input of Swedish produce differs from the overseas fruits and berries' input by factors of two (for apples, cherries) and five (for strawberries). Fresh food produced in a different country of the same region apparently requires a less transport-intensive supply system. For instance, Eastern or Southern European apples, cherries, and strawberries brought to Sweden require 1.2–1.4 times higher energy input than analogous Swedish products. In addition, it is interesting to compare the energy intensity of different production methods: for example, Swedish tomatoes grown in a greenhouse result in 66 MJ/kg of life-cycle energy input per kg, while open-grown Southern European tomatoes take 5.4 MJ/kg (Saunders, 2008), including the shipping energy to Sweden.

Another important driver of increased energy use in food production is the decrease of seasonally restricted consumption and the corresponding increasing demand for heated greenhouses or transport services. Increasing cooling demand, the globalization of the food system with corresponding transport distances, and the growing importance of processed convenience food and eating out are also important drivers.

21.2.2 Mobility[3]

The energy implications of lifestyle choice are closely related to certain mobility choice patterns. Vehicular ownership does not always mean high energy use, as the latter depends on mobility. With tourism demand rising, long distance mobility patterns are also increasing, especially air travel. The vehicle population in Beijing and Shanghai is about one-tenth that of Tokyo, while their total fuel use is one-third to one-half as high because of lower fuel economy and more miles driven. Both these components are very high in the United States.

Mobility per se is not always a goal in itself. It is about accessibility to various activities (home, work) and also for some to go places for individual recreation, or to the sources of services and products (medical appointments, shopping, etc.; see also Chapter 9). Passenger-kilometers traveled are increasing worldwide, with the United States alone accounting for 65% of total global passenger-kilometers traveled.

3 Please see Chapters 9 and 18 for a more detailed discussion.

Individual and household decisions on the choice of private space, suburban or city life, income, recreational demand, social status, conspicuous consumption, and so on all determine the level of mobility services demanded and the mode of transport chosen. Social theorists have also described how the disappearance of norms and economic limitations has gradually removed the restriction of individual choices and made "individual lifestyles" an appropriate way to describe differences in worldviews and consumption (Giddens, 1996; Beck, 1997; Jensen, 2008; Bauman, 1998). In societies with more value for individual space and freedom, private car mobility becomes of primary importance. The number of passenger cars is still increasing in industrial countries (World Bank, various years).

Despite increasingly more efficient engines and some attempts to promote smaller and lighter cars, motor power and the number of electronic appliances in automobiles continue to increase – with correspondingly increasing energy demand (Chapter 9). This is partly due to the aggressive marketing strategy of automobile production and distribution companies. Similar developments of increased energy services can be observed in public transport.

People in many countries will continue to depend on private cars for a long time. In countries such as the United States, widely spread-out urban living areas with low population density and inadequate public transport infrastructure necessitate private car mobility. Good practices in human settlement design – more densely populated areas; bicycle lanes; bans on parking in overcrowded areas, etc. – could counteract this development, but these are largely not replicated in newly growing and highly populated urban areas in developing countries. Furthermore, the private car seems convenient, as it is perceived to allow maximal personal freedom. So drivers systematically disregard the inconvenience of congestion and the value of using their time for other activities while they are on private transport.

21.3 Determinants of Lifestyle Choices

In many health disorders such as obesity, lifestyle choice itself is considered an extrinsic factor, as opposed to genetic factors which are intrinsic factors. Being an extrinsic factor, lifestyle choice is often times considered to be a decision variable and amenable to change. However, an in-depth analysis shows lifestyle choice itself gets determined by a host of other factors, some of which can be changed by individual decision (e.g., choice among available diet options, acquired dietary pattern) and some needs more landscape level intervention (e.g. culture, value, social norms) or macro policy (e.g., infrastructure design) intervention. Homogeneity in infrastructure and human settlement design has led to a convergence in energy service demand across various cultures and geography. Infrastructure design choices are top-down decisions and are beyond individuals. In many energy-supply system designs, the management level of consumer demand is taken as a given based on the assumption that preferences have an intrinsic character. But a lifestyle and consumption-based approach takes into consideration various extrinsic drivers for preference which changes over time. Consumer demand for energy is determined by, among other things, infrastructure design as well. For example, it is impossible to sit on a veranda in the cool of the evening if a mechanically air-conditioned home is built without one (Shove, 2003). Individuals cannot choose to switch off their own heating or cooling services if a building is centrally heated and air-conditioned.

A number of economic (e.g., the market price for land) and institutional factors (e.g., zoning) influence land use. Factor often seeming to be left out of individual decisions are human health and environmental co-benefits. Traditional walking, bicycling, jogging, and natural green spaces are getting taken over by energy-guzzling "modern" energy-intensive health services and highly irrigated green spaces; small traditional retail stores are getting replaced by air-conditioned shopping malls. Approaches based on supply-side economics or partial end-use activities fail to take into consideration the lock-in effect of infrastructure design, which constrains demand at very high levels and leaves no flexibility to generate behavioral responses. People's choice not to switch off standby power to reduce phantom load (Roy and Pal, 2009), for instance, may be due to lack of easy access to power switches in a house.

A variety of internal and external factors influence consumer choice in areas of importance for energy use. There is, for example, evidence that religion influences consumer attitudes and behavior in general (Delener, 1994; Pettinger et al., 2004). A number of studies demonstrate that religion influences eating habits (Mennell et al., 1992; Steenkamp, 1993; Steptoe and Pollard, 1995; Shatenstein and Ghadirian, 1998; Asp 1999; Mullen et al., 2000; Blackwell et al., 2001). In many societies, religion even plays one of the most influential roles in food choice (Musaiger, 1993; Dindyal, et al., 2004).

The impact of religion on food consumption obviously depends on the religion itself. Several religions forbid certain food, such as pork and meat that has not been ritually slaughtered in Judaism and Islam, or pork and beef in Hinduism and Buddhism (Sack, 2001). Although religions may impose strict dietary laws, the number of people following them may vary considerably. For instance, it is estimated that 90% of Buddhists and Hindus (Dindyal, 2003) and 75% of Muslims compared with only 16% of Jews in the United States strictly follow their religious dietary laws (Hussaini, 1993). Due to the largely vegetarian diet of Hindus, changes in these percentages can be of considerable relevance for energy demand as energy input difference between plant- and meat-based meals may exceed a factor of 10 (see Section 21.2.1). Evidence shows that embodied energy use in an average diet which contains both vegetarian and non-vegetarian items can be almost 1.3 to 1.5 times higher than a vegetarian diet (see Figure 21.4). Differences in adherence to religious dietary prescription pertain, among other factors, to social structures, such as origin, immigration, and generation differences (Limage, 2000; Saint-Blancat, 2004; Ababou, 2005). At the same time, factors such as income convergence, markets, technology, media, and trade are leading to a homogenization in dietary patterns, thereby indicating a trend toward higher energy demand that may not be necessarily healthy.

Faiers et al. (2007) list the relevant theories and models that have been developed to explain these factors, building on a review by Jackson (2005). Further insights into the significance of these factors for consumer purchases of "green" products is provided by Ozaki and Sevastyanova (2011), who analyzed the purchase motivations of UK buyers of the Toyota Prius hybrid. They suggest that the various motivational factors could be grouped into five clusters: financial benefits; hybrid cars as exemplars of "environmentalism;" compliance with the norms of the community; attractiveness of new technology; and independence from oil producers by reducing petrol use. While their study underscores the importance of financial factors, the effects of social pressure and the aesthetic, experiential, and practical values associated with hybrid cars were also found to be important. This multidimensionality of purchase motivations highlights the importance of social, cultural, and perceptual factors in lifestyle choices, in addition to purely economic (or benefit-cost) calculations.

A cross-cultural analysis of household energy use behavior in Japan and Norway found certain similarities and differences in energy use patterns (Wilhite et al., 1996). People in both countries have good information about how much energy goes where in the home, but they exhibit an almost total lack of interest in energy efficiency and concern about the environment when shopping for appliances. In Japan, the bathing routine is extremely important to the Japanese lifestyle and at the same time very energy-intensive. Norwegians heat most of their living area most of the time, while the Japanese traditionally heat only where they are in the home and when they are there. Part of the explanation for this is culture and part is climate. When it is very cold outside, as it often is in the Norwegian winter, it is both physically and psychologically comforting to have it very warm inside (Wilhite et al., 1996).

Lyons et al. (2007) maintain that Ireland's consumption has not developed as in other European countries with increasing or high incomes but instead remains similar to that of Greece. In essence, as the rise in wealth and incomes has been very quick, consumers have not yet adjusted their spending habits and there is still room for convergence in consumption patterns. Although the Irish no longer have low incomes, they still behave, to a certain extent, as if they had.

Of particular relevance for energy services demand is the rural-urban divide especially in developing world. On average, rural incomes and expenditure levels are significantly lower than in urban areas. While a rural household's consumption pattern is biased toward food items, an urban household's expenditures have bigger shares in services (Ojha et al., 2008). Rural and urban lifestyles are influenced by the huge diversity in settlement design, infrastructure availability, and service provisions. Rural areas are more often served by decentralized systems and generally exhibit less motorized mobility and fewer modern amenities. Unless the energy-saving potential of lifestyle change is accounted for, homogenization in urbanization trends and human settlement design in newly developing areas will end up creating high-energy-using spaces. So infrastructure design needs to be diversified as well as culture-specific.

Identifying consumer preferences is a key challenge facing manufacturers and service providers. The media has been used as a powerful mass-communication tool for creating awareness and shaping public opinions. Two glaring examples of media effect on lifestyles are the successes of anti-smoking campaigns and campaigns, true across countries today, to use seat belts in cars. Wakefield et al. (1998) conclude that media can shape and reflect societal values.

21.4 Influencing Preferences and Consumer Behavior

Dietz et al. (2009) have estimated that behavioral changes involving the adoption and altered use of currently available in-home and personal transportation technologies in the United States could reduce carbon emissions by as much as 7.4%. This would require a range of nonregulatory interventions at multiple levels (individuals, communities, businesses), including interventions to address barriers to behavioral change (information, appeals, incentives) and the use of social marketing that combine mass media appeals with participatory, community-based approaches.

Many interventions to promote household efficiency do not succeed, at least to the extent expected, due to a failure to understand how people think about and make decisions regarding energy efficiency (Vandenbergh et al., 2010). For example, as Attari et al. (2010) demonstrate, householders systematically underestimate the potential for energy savings and as a result may conclude that the energy-saving actions may yield inadequate economic benefits. This happens as a result of the self-education that individuals use in making quantitative judgments about risk. Dietz (2010) suggests that linking the risk perception literature with the social psychological literature on consumption might improve the understanding of decision making regarding environmentally significant consumption.

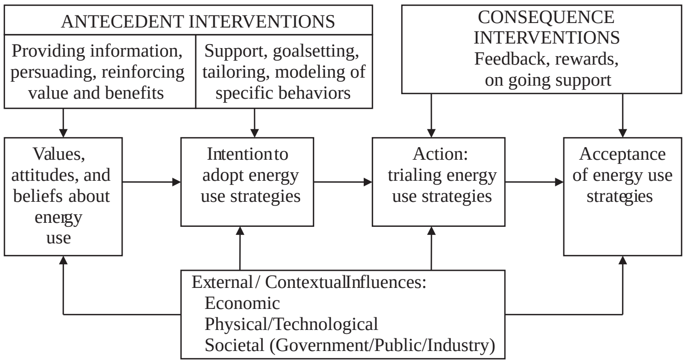

Figure 21.6 | A model for behavioral change for energy use. Source: Gardner and Ashworth, 2008.

21.4.1 Information, Knowledge, and Education

Behavioral change requires both knowledge contributions to change attitudes and policy implementation to provide incentives for action. In order to achieve constructive behavioral change toward energy use, one conceptual model (adapted from Gardner and Ashworth, 2006) indicates the potential for knowledge-based interventions to increase the intention to adopt energy use strategies. Such interventions also require an understanding of factors that can influence attitudinal and behavioral change, such as situation, habits, and experience (Vaughan, 1977). The processes used to accomplish change in people's attitudes and behaviors can include persuasion or reason – or a combination of these (Cooper and Hogg, 2002).

Several models and perspectives on how to change behaviors and attitudes are available, including cognitive dissonance theory (Oskamp, 2000), the theory of planned behavior (Ajzen, 1989), the theory of reasoned action (Ajzen and Fishbein, 1980), and the theory of consumer uptake and societal acceptance (Niemeyer, 2004). Figure 21.6 (adapted from Gardner and Ashworth, 2006) presents a synthesis of many of these models and approaches. One of the key issues that needs to be accounted for in any behavioral change model is the effects of external and contextual influences. These elements cannot be controlled for, yet they can have a lasting impact on behavior.

One key element that is not included in the model but that is essential to address when specifically engaging on consumption is the issue of threat. Engaging people on reducing energy use requires a constructive response from the community to actual or perceived threats. Moser and Dilling (2007) raise caution about using fear to change behaviors. Many studies have shown that fear may change attitudes and other forms of expression but it does not necessarily assist active engagement or the changing of behaviors (Ruiter et al., 2001; Moser and Dilling, 2007). Based on a summary of research (e.g., Das et al., 2003; Ruiter el al., 2004; Moser and Dilling, 2007), achieving a productive behavioral and attitudinal outcome requires community members to:

- feel personally vulnerable to the risk;
- have useful and very specific information about possible precautionary actions;
- positively appraise their own ability (self-efficacy) to carry out the action;
- feel the suggested action will effectively solve the problem (response efficacy);
- believe the cost associated with taking precautionary action is low or acceptable;
- view the reward for not taking the action as unappealing; and
- tend to consciously and carefully process threat information (i.e., engage in central/systematic processing as opposed to peripheral/heuristic information processing).

Ten years of experience at the Akatu Institute for Conscious Consumption in Brazil have indicated that it is necessary to show individual consumers or small groups of consumers that any one person or a small group of people can have an enormous impact (Worldwatch Institute, 2010: 107). This helps persuade consumers that even an individual can have a strong positive contribution toward sustainability by changing individual consumption habits – and more so if each individual acts as a mobilizer in society for new ways of consuming that could have a much lower impact, especially on nature. The environmental movement in the last 20–30 years has focused on this aspect of sensitizing individual consumers of their responsibilities. With networking's technological advance, virtual communities are becoming very popular and have a global presence, and they can be a good means to reach out to a community. Consumers are seen as being increasingly important in the design and implementation of public policy and decisions about the delivery of services (Entwistle and Martin, 2005) and also as peer monitoring groups.

Neighborhood efforts to reduce energy use work better with realistic instructions and assessments of the threat, diagnosis and strategies, social support, people's sense of personal control over their circumstances, low-cost alternatives, and regular feedback that allows people to see that they are moving in the right direction (Morse and Doberneck, 1995; Groopman, 2004). One example of an initiative aimed at increasing knowledge among citizens and supporting concrete action is the Energymark initiative of the Commonwealth Scientific and Industrial Research Organisation in Australia. (See Box 21.1.) It shows clearly that the holistic approach to energy service demand by targeting consumers rather than any end-use component can deliver behavioral change and reduce demand for energy services.

Box 21.1 | The Energymark Initiative, Australia

The Energymark process brings together small groups of people, meeting at their own pace, to discuss energy technologies and climate change. Individuals read scientific factsheets and share their thoughts, barriers, challenges, anecdotes, and first-hand experiences. There are two benefits of this process. First, it ensures a coordinated approach to researching public perceptions of climate change and energy technologies across Australia in order to generate insights and provide an empirical benchmark for other researchers. Second, engaging the public in this way ensures the information is more likely to be translated into action by individuals because they can relate to the concepts, discuss them openly, and change their behaviors accordingly.

In total, the Energymark trials had 1713 participants from various regions of Australia, including a wide range of age groups and balanced gender representation. Following the meetings, there was a significant change in participants' knowledge, attitudes, and intended and actual behaviors. For how long these are sustained can be judged by follow up programmes. A carbon footprint calculator provided evidence that the average carbon footprint was reduced by 20.5% due to involvement in the Energymark process. The groups took, on average, 8.5 months to achieve this. Based on the costing and abatement achieved, the program could save in total 7452 tonnes of CO_2 (i.e., 4.35 tonnes per participant) in 8.5 months at an initial investment of approximately US$500,000 (US$250,000 committed to operational expenses related to conducting the trial and US$250,000 for writing of the materials and establishing communication systems). Once the operational systems have been established, the cost associated with conducting more Energymark groups would be reduced. From the trial, the overall investment was 7.4US¢ to save 1 kWh through behavioral change, which is compatible with the current rate of electricity supply in Australia of around 8–16US¢/kWh.

21.4.2 The Role of Policies[4]

Detailed prescriptions and laws regulating individual consumption decisions could be supplementary to strengthen informational impact and serve as proxies for the beneficial reduction effects of carbon pricing and other instruments based on economic efficiency. Such prescriptions and laws can increase both technical and economic efficiency, while admittedly not reaching the first-best optimum. They could also be designed in an equitable way. They would, however, be very paternalistic and would interfere with individual freedom in an unacceptable way for a liberal society if implemented in due strength to trigger significant effects. Questions would arise about whether driving heavy private cars, eating meat, or traveling by airplane and private jet should be prohibited or drastically restricted.

Finally, there is a striking lack of political will, which may be the most important problem for the implementation of effective energy policy. Many energy policy instruments have exceptions, and existing gasoline taxes in almost all countries in varying degrees are way below the levels necessary for significant reductions, as can be derived from the research on price elasticities of demand for energy-intensive goods and services (see, e.g., Smith et al., 1995; Enevoldsen et al., 2007; Sterner, 2007). Stringent energy policy depends on the presence of societies that are willing to take on this burden (or chance), politicians who are willing to stand for such actions, and people who are willing to support such politicians and policies. This also limits the effectiveness of information provision as an energy policy instrument to target individual consumers, as can be seen from the mismatch of the current level of information and the actions taken by individuals. Both costs and benefits associated with any action has important role to play. The extent to which promotional efforts succeed and the degree to which people are willing to "curb their consumption levels for the greater good of the community" (Brown and Cameron, 2000) depend on the existence of an underlying bedrock of environmental commitment.

Additional intervention options are built around the insights mentioned in the previous sections: they target energy services demand and not energy use; they account for lifestyle and well-being aspects – which can become a hindrance as well as support for reduced energy services demand. Ultimately, these alternative policy instruments need to build and develop a strong commitment to the environment, as the classical policy instruments alone do not work to deliver full potential.

Alternative policy options are found in the context of sufficiency strategies, which make the levels of energy services themselves a topic for discussion and aim at lowering those. Sufficiency thus addresses the "level" of output (or consumption) per se – and not in relation to the inputs (as technical efficiency does). It asks whether an activity needs to be performed at all (excess meat consumption, multiple car ownership, or extraordinarily high mobility service demand) and not whether it is performed "efficiently." A combination of existing and additional instruments is most promising for reducing the externalities of energy use.

4 Policy issues are discussed in more details in Cluster IV (Chapters 22–25).

Table 21.2 | Well-being, lifestyle change, and energy savings potentials

Lifestyle Change to Enhance Well-being	Consumption Category Intervention Point	Barrier	Energy-Savings Potential	Policy/Action (individual and public)/Regulation	Co-benefits
Less wasteful electricity usage behavior	Phantom load on electricity supply	Infrastructure design	10% of average energy bill[1]	Manual switching off of standby power points Informational campaigns	Freeing electricity for redistribution or savings in fossil fuel use and resulting emission
Healthy dietary choice with prescribed healthy meat consumption[2]	Energy embodied in excess per capita meat consumption	Marketing strategy by meat processing industries, diet gurus	1.4% of global primary energy use	Informational campaigns with better health advisory based on upper limit for meat consumption	GHG mitigation strategy; freeing up water, land, health equity through allowing consumption to rise in below-average consumption countries
Healthy lifestyle practice like walking /bicycling/more public transport usage and maximum of one car per household//kilometers driven per household	Fossil fuel using transport mode	Distorted market price (land price driven by real estate market), policy failures like government subsidy for grazing lands, wrong evaluating criterion, like conventionally measured GNP	1.3% of global primary energy use[3]	Informational campaign on reduced mobility and ill health effects Less time allocated for watching TV etc. Infrastructure design Congestion-free walkway, parks/open spaces with greenery to replace energy-guzzling gyms	Larger global mobility with same fossil fuel use

1 Roy and Pal, 2009.

2 Limit of lean meat consumption per year recommended by American Heart Association is per capita per year 62.6 kg (Caspari et al., 2009). Currently FAO statistics show 54 countries have per capita annual consumption higher than the standard ranging between 63.2 (Mexico)-122.79 (USA).

3 Estimated using information on energy use and alternative green lifestyles in Christensen, (1997).

The current debate on sustainable energy systems is largely dominated by technical and economic efficiency and clean energy strategies, while sufficiency plays a minor role only. Nevertheless, many official reports dealing with the question of how to reduce emissions and energy acknowledge the crucial importance of changes in lifestyles and consumption patterns (Duchin, 1998; OECD, 1998; Lundgren, 1999; Alfredsson, 2002; ECEEE, 2006; Kaenzig and Jolliet, 2006; IPCC, 2007; DEFRA 2008). This may be due to the fact that in most cases it is not clear what is meant by changed lifestyles or consumption patterns or how to bring about those changes.

It is not only individuals who have to be targeted. Lifestyles with certain levels of comfort and high energy services demand have not necessarily evolved from individual choices. The accomplishment of comfort is entwined with fashion and property development and design. It is increasingly difficult to buy a new car that does not come readily equipped with air-conditioning. Working only at the level of individuals thus may not lead to the transformational change in lifestyle needed for a more sustainable society. So change in top-down decisions in infrastructure design, as described earlier, and educating communities (as in the Energymark Initiative) might be needed.

Table 21.2 shows various alternative additional entry points to gain energy-saving potentials from the demand side to add flexibility to supply options through lifestyle change that are win-win options so far as the goal of sustaining well-being is concerned.

21.4.3 Role of Actors

National and international agencies: government, private, communities and civil societies should be encouraging the proliferation of regional (climate-sensitive) understandings of comfort and the development of a corresponding variety of local socio-technical regimes. The definition of comfort should be the subject of explicit discussion and debate. Ecologists (Diamond, 1997; Millennium Ecosystem Assessment, 2005) are revisiting the values of local ecosystems and trying to put higher value to niches in local systems. Multiple stakeholders are seen as being increasingly important in the design and implementation of public policy and decisions about the delivery of services (Entwistle and Martin, 2005) and also as a peer monitoring group. Stakeholders have been described as those who have an interest in a particular decision, either as individuals or representatives of a group. This includes people who influence a decision, or can influence it, as well as those affected by it. The community of stakeholders can become active with regard to some policy goals. Information campaigns can be embedded in several contexts, some examples are in the Energymark example described earlier.

Corporations and all kinds of organizations can also drive information campaigns. Corporation/organizations promote lifestyles that penetrate society through their own direct consumption structure, product labeling, and purchase policies. Labeling schemes (OECD, 2009) are an important initiative, as labels provide comparable information for consumers to make informed purchase decisions. Green Labels in

Europe aim at increasing greener procurement through the promotion of energy-efficient products and awareness-raising. Examples are the Swan label for over 50 different products, the Group for Energy Efficient Appliances label for home and office appliances, and the Blue Angel label for environmentally friendly consumer goods and services (OECD, 2009), as well as Energy Star labels for energy-efficient home appliances in India (BEE, 2011). Marketing strategies play a significant role, for instance, by selecting a limited range of products that are "approved" by a company as energy-efficient. Good practices, such as encouraging employees to use carpools, bicycles, or walking for health reasons and observing Environment Day[5], Earth Day[6], Biodiversity Day[7], and so on, have the potential to change behaviors. Such labeling has led to new product development as well.

In the past, environmental disagreements between corporations and environmental groups were addressed through long, drawn-out conflicts in the news media, open-ended lengthy administrative processes in government agencies, or costly litigation (Piasecki and Asmus, 1990). Today, a more cooperative spirit can often be observed. Emerging corporate citizenship practices benefit both businesses and the communities in which they operate. Corporate environmental citizenship activities often include donations and gifts for environmental programs and incentives for employees to work with community groups on natural resource conservation and protection. Clearly, information campaigns need also be led by civil society, educational institutions, and families. Schools have a mandate to motivate and inform students. This needs to be part of school curriculum which can involve parents' participation as well otherwise there will be counter information with the possibility of undermining the actions otherwise initiated. A holistic approach can only reinforce positive actions by diverse groups of actors.

21.5 Beyond Affluence to Well-being

Well-being denotes quality of life. Numerous indices have emerged to help measure well-being through various changes in quality of life. These are being used to make comparisons across groups, nations, and time. They also help determine whether these changes are sustainable, and they evaluate policies.

For a long time, and still predominantly today, human well-being tends to be associated largely with increased levels of consumption of products and services, a rising income and the purchasing power to support this increased consumption, and a rise in energy use. In this respect, income is the measure of wealth dividing the "rich" from the "poor." Consequently, conventionally gross national product (GNP) or gross domestic product (GDP) is the measure of choice and one that has dominated the literature.

This dominant economic notion has been challenged periodically over the years. One of the early challenges came during the 1970s, with the rise of public awareness about environmental and sustainability concerns. Serious doubts were raised as to whether traditional economic growth models were adequate in view of these new issues. This led to a broader discussion and debate about indicators of well-being. As a measure of aggregate economic activity, conventionally defined GNP or GDP does not capture social well-being, social inequities, or the depletion of natural resources. As a result of this debate, several new approaches emerged that have tried to include other aspects of well-being (Hanley et al., 1997; Hamilton and Clemens, 1999; Dasgupta, 2001).

Many of the new emerging approaches put greater emphasis on issues of poverty and provide new definitions of wealth, new ways to treat environmental degradation, and new indices to measure the quality of life (e.g., Dasgupta, 1975; IUCN, 1980; Norgaard, 1984; El Sarafy, 1989; Daly, 1990; Daly and Cobb, 1990; UNDP, 1990; Dasgupta and Maler, 1991; Commons and Perrings, 1992; Dasgupta and Maler, 1995; Hanley et al., 1997; Sen, 1999; Aggarwal et al., 2001; Dasgupta, 2001).

Measures of well-being can be classified (Dasgupta, 2001) according to whether they are based on constituents (outputs) of well-being such as health, happiness, or freedom or on the determinants (inputs) of well-being such as expenditures on food, nutrition, clothing, potable water, shelter, and access to knowledge or information. Economic literature has tended to focus on the latter, while moral philosophers and many in the social sciences have focused on the constituents of well-being. Newer indices have tried to combine both the determinants and the constituent elements of well-being.

Some recent proposals focus on the happiness index (Namgyal and Wangchuk, 1998). But many commentators, despite accepting the importance of happiness, have questioned these as being subjective, unobservable, and difficult to quantify (Kahneman et al., 1997). Theoretical and empirical research (Dasgupta, 1995, 1997; Frey and Stutzer, 1999, 2000; Narayan et al., 2000) has tried to establish more objectively the links between states of happiness and wealth or the lack therefore, employment, and the command of natural resources. Notwithstanding their deficiencies, some of these indices can be useful as supplementary tools to indicate potential entry points for policy interventions.

In response to the shortcomings of conventionally measured GNP and its tendency to measure aggregate "economic activity" rather than "social well-being," the United Nations Development Programme introduced the Human Development Index (HDI) (UNDP, 1990; 2010). Besides conventionally measured GNP (as a proxy for purchasing power based well-being), the HDI includes adult literacy and life expectancy at birth as additional crucial aspects of well-being. Despite the shortcomings of this index – it does not measure inter-temporal well-being and is still

5 http://www.unep.org/wed/

6 http://www.earthday.org/earth-day-history-movement

7 http://www.cbd.int/idb

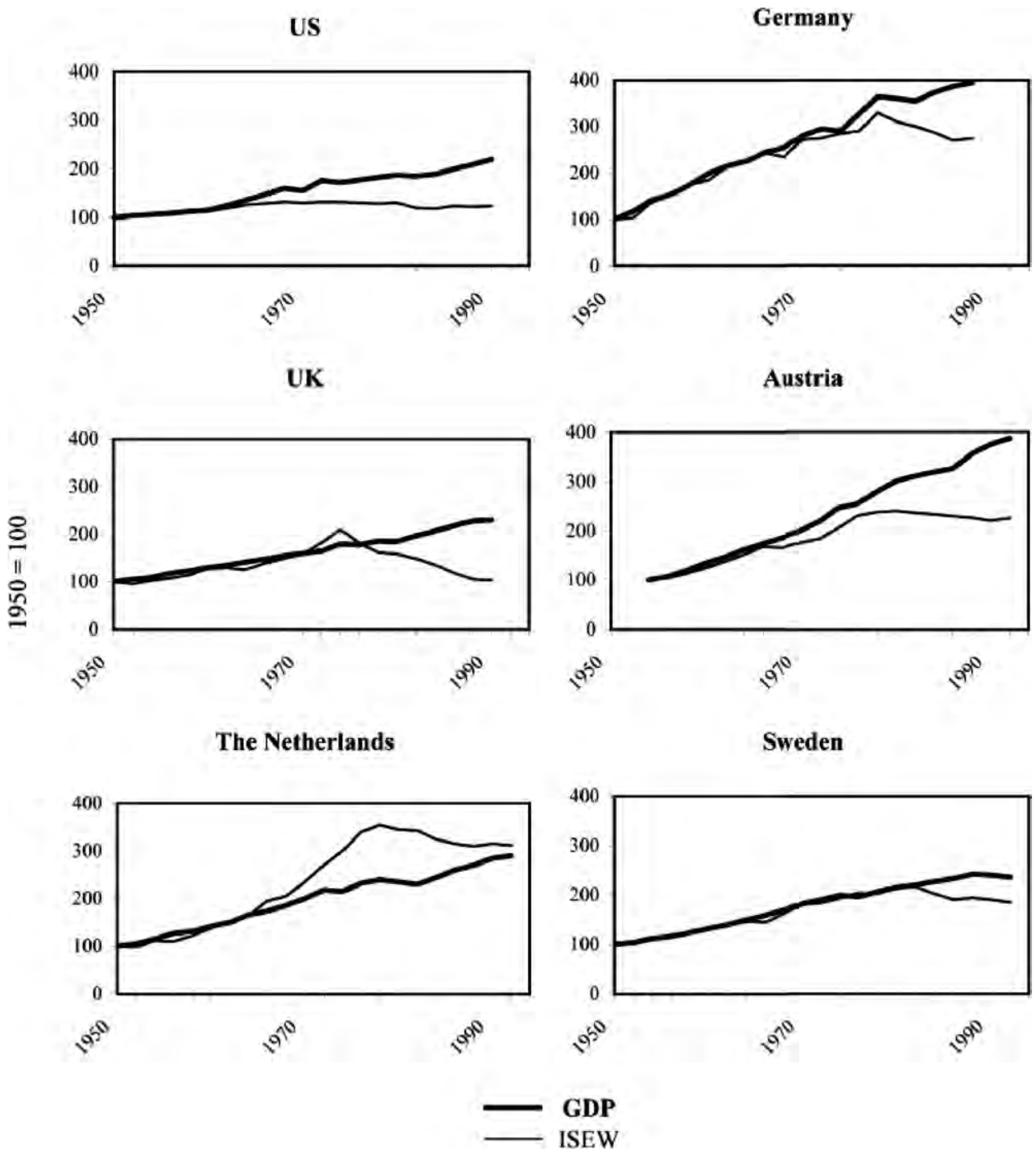

Figure 21.7 | Comparison of macro indicator: GDP and ISEW for the United States, Germany, United Kingdom, Austria, the Netherlands, and Sweden. Source: Lawn 2003.

too limited in terms of determinants of well-being – many consider the HDI a step in the right direction.

Regarding the use of consumption level as an index of well-being, studies have shown that in poor countries and communities, indices of consumption can serve as determinants of well-being and happiness. For rich countries and communities, however, the inclusion of current consumption as a measure of well-being may not be as useful or appropriate because current consumption may not be a contributing factor to happiness of people who have much more than the basic necessities (Esterlin, 1974). Empirical research also shows that the correlation between income and individual well-being becomes weak beyond a certain level of wealth and that further increases of economic wealth do not necessarily increase individual well-being. Thus the need for more than one index to keep track of various constituents and determinants of well-being depends on the situation being considered (Nussbaum, 2000). However, the fact remains any composite measure can be non-robust to changes in weights on the components.

The concepts of well-being just described have important implications on how energy services demand and energy use are assessed. A focus on conventionally defined GNP/GDP alone is biased toward viewing changes and reductions in energy services demand as decreases in well-being. More complex notions of well-being are better able to take other factors into account even in situations of decreasing energy services.

Notions of well-being based only on consumption implicitly assume that there is high substitutability between different energy services, while more complex, multidimensional notions can capture differing characteristics of energy services that may actually hinder substitutability. This is of particular importance when addressing basic needs for a decent good life and the energy services demand to meet those. The assumption of substitutability is important, as assumptions about it can, for example, lead to overestimations of well-being when the aggregate quantity of energy use is considered but not its qualitative composition (Pachauri et al., 2004).

In the long run, however, transformational change is possible by changing the social value system and through the adoption of a better quality of life, as indicated by a Well-being Index in addition to, and other than, conventionally measured GNP, HDI or similar such new indices. Over the years a number of different indices have been developed to measure and compare the benefits and costs of growth. The first of these was Index of Sustainable Economic Welfare (ISEW). Over this time, the ISEW has been given a variety of different names and theoretical underpinning – for example, a Genuine Progress Indicator or GPI and a Sustainable Net Benefit Index or SNBI (Lawn, 2003). Empirical studies in the context of developed economies have demonstrated that there may be a threshold level for growth beyond which growth of macroeconomic system is not beneficial to human well-being. Divergence between the ISEW and conventional measures of GDP beyond a point is clearly shown in Fig 21.7. Beyond threshold, or peak, as shown by ISEW, SNBI and GPI, the suggestion is goal of these countries need to move away from growth objective to sustainable development goals. This peak is not observable in GDP measure which is the rising curve. These studies strongly support the need for refinement of new welfare & well-being measures. It also highlights the need to better link energy use with such alternative measures.

Finally, the potential for increased sustainability that lies in strong decoupling of well-being from consumption can be captured by notions of well-being that are not based on consumption. This offers new policy options of potentially high leverage. A reduction in energy services and energy use demand does not necessarily reduce well-being. And lifestyle changes can deliver some win-win options that reduce demand for energy services with the same or even improved levels of personal and social well-being.

Changes in preferences and attitudes of individuals are essential in long-term sustainable lifestyle change. In working toward sustainable energy futures, the role of the individual is crucial. "Sufficiency" is a key term in this discussion. Sufficiency directly addresses the individual, and its concepts of well-being and lifestyle aim at a thorough discussion of societal values (Muller, 2009). Leading a "sufficient" life means leading a life of moderation and prudence. This means developing awareness of the consequences of actions beyond monetized cost-benefit analysis and of markets beyond local or regional scope. Moderation would curb further growth in energy use with the corresponding externalities, including harm to others.

Numerous successful changes in lifestyles and acceptance of values such as "sufficiency" have taken place since World War II. Sufficiency notions have provided impetus for discussion and debate on society's values and the role of its citizens (Harvey, 1996; Goodman, 2010). Some of these successes provide a rich ground for exploring new measures and policies to encourage lifestyle changes in key areas of energy use in the near future as well as the development of new and more appropriate indices.

The literature on alternative indices of well-being is not conclusive enough operationally to replace conventionally measured GNP – the current index of economic well-being. There is a methodological and information gap on the energy outcome of alternative lifestyles at global and regional scales. Alternative consumption-based approaches need to be compared with supply-side-based approaches in terms of the implications for primary energy use. In public discussions, sufficiency is often related to renunciation. This nexus is always made on the basis of the current consumption level and lifestyle. Instead, efficiency-led strategies need to be tied to sufficiency to become a widely used strategy that changes values and notions of well-being.

More research is needed to assess the macroeconomic effects of large-scale switches to more-sufficient lifestyles over various time scales in the future. A key issue is how a large reduction in consumption could be absorbed by the economy without generating large unemployment. Simultaneous redistribution of labor could offer a solution, but further analysis of this is clearly needed.

References

Ababou, M., 2005: The Impact of Age, Generation and Sex Variables on Religious Beliefs and Practices in Morocco. *Social Compass*, **52**(1): 31–44.

Aggarwal, R., S. Netanyahu and C. Romano, 2001: Access to Natural Resources and the Fertility Decision of Women: The Case of South Africa. *Environment and Development Economics*, **6**(02): 209–236.

Ajzon, I. and M. Fishbein, 1980: *Understanding Attitudes and Predicting Social Behavior*. Prentice Hall, Englewood Cliffs, NJ, USA.

Alfredsson, E. C., 2002: *Green Consumption Energy Use and Carbon Dioxide Emission*. Doctoral Thesis, Department of Social and Economic Geography, Spatial Modelling Centre, Umeå University, Umeå, Sweden.

Alfredsson, E. C., 2004: "Green" Consumption – No Solution for Climate Change. *Energy*, **29**(4): 513–524.

Asp, E. H., 1999: Factors Affecting Food Decisions Made by Individual Consumers. *Food Policy*, **24**(2–3): 287–294.

Attari, S. Z., M. L. DeKay, C. I. Davidson and W. Bruine de Bruin, 2010: Public Perceptions of Energy Consumption and Savings. *Proceedings of the National Academy of Sciences*, **107**(37): 16054–16059.

Baroni, L., L. Cenci, M. Tettamanti and M. Berati, 2006: Evaluating the Environmental Impact of Various Dietary Patterns Combined with Different Food Production Systems. *Eur J Clin Nutr*, **61**(2): 279–286.

Bauman, Z., 1998: *Work, Consumerism and the New Poor*. Open University Press, Berkshire, UK.

Beck, U., 1997: *Risikoamfundet – På Vej Mod En Ny Modernitet*. Hans Reitzel, Copenhagen, Denmark.

BEE, 2011: *National Energy Labeling Programme*. http://www.beeindia.in/ (accessed 28 August, 2011).

Benders, R. M. J., R. Kok, H. C. Moll, G. Wiersma and K. J. Noorman, 2006: New Approaches for Household Energy Conservation – in Search of Personal Household Energy Budgets and Energy Reduction Options. *Energy Policy*, **34**(18): 3612–3622.

Bertilsson, G., H. Kirchmann and L. Bergström, 2008: Energy Analysis of Organic and Conventional Agricultural Systems. In *Organic Crop Production – Ambitions and Limitations*. H. Kirchmann and L. Bergström (eds.), Springer, Dordrecht, the Netherlands, pp. 173–188.

Biesiot, W. and K. J. Noorman, 1999: Energy Requirements of Household Consumption: A Case Study of the Netherlands. *Ecological Economics*, **28**(3): 367–383.

Bin, S. and H. Dowlatabadi, 2005: Consumer Lifestyle Approach to US Energy Use and the Related CO_2 Emissions. *Energy Policy*, **33**(2): 197–208.

Blackwell, R. D., P. W. Miniard and J. F. Engel, 2001: *Consumer Behavior*. Harcourt Inc., Orlando, FL, USA.

Brown, P. M. and L. D. Cameron, 2000: What Can Be Done to Reduce Overconsumption? *Ecological Economics*, **32**(1): 27–41.

Carlsson-Kanyama, A., M. P. Ekström and H. Shanahan, 2003: Food and Life Cycle Energy Inputs: Consequences of Diet and Ways to Increase Efficiency. *Ecological Economics*, **44**(2–3): 293–307.

Caspari, C., M. Christodoulou, J. Nganga and M. Ricci, 2009: *Implications of Global Trends in Eating Habits for Climate Change, Health and Natural Resources*. DG-IPOL-STOA-ET(2009)424735, Science and Technology Options Assessment (STOA), Directorate General for Internal Policies, European Parliament, Brussels, Belgium.

Christensen, P., 1997: Different Lifestyles and Their Impact on the Environment. *Sustainable Development*, **5**(1): 30–35.

Cohen, C., M. Lenzen and R. Schaeffer, 2005: Energy Requirements of Households in Brazil. *Energy Policy*, **33**(4): 555–562.

Coley, D. A., E. Goodliffe and J. Macdiarmid, 1998: The Embodied Energy of Food: The Role of Diet. *Energy Policy*, **26**(6): 455–459.

Collins, A. and R. Fairchild, 2007: Sustainable Food Consumption at a Sub-National Level: An Ecological Footprint, Nutritional and Economic Analysis. *Journal of Environmental Policy & Planning*, **9**(1): 5–30.

Common, M. and C. Perrings, 1992: Towards an Ecological Economics of Sustainability. *Ecological Economics*, **6**(1): 7–34.

Cooper, J. and M. A. Hogg, 2002: Dissonance Arousal and the Collective Self. In *The Social Self: Cognitive, Interpersonal and Intergroup Perspectives*. J. P. Forgas and K. D. Williams (eds.), Psychology Press, New York, NY USA.

Cranfield, J. A. L., T. W. Hertel, J. S. Eales and P. V. Preckel, 1998: Changes in the Structure of Global Food Demand. *American Journal of Agricultural Economics*, **80**(5): 1042–1050.

Daly, H. E., 1990: Toward Some Operational Principles of Sustainable Development. *Ecological Economics*, **2**(1): 1–6.

Daly, H. E. and J. B. Cobb Jr., 1990: *For the Common Good: Redirecting the Economy toward Community, the Environment and a Sustainable Future*. Green Print, London, UK.

Daly, H. E., 1996: Consumption: Value Added, Physical Transformation and Welface. In *Getting Down to Earth: Practical Applications of Ecological Economics*. R. Costanze, O. Segura and J. Martinez-Alier (eds.), Island Press, Washington, D.C., USA, pp. 49–59.

Das, E. H. H. J., J. B. F. de Wit and W. Stroebe, 2003: Fear Appeals Motivate Acceptance of Action Recommendations: Evidence for a Positive Bias in the Processing of Persuasive Messages. *Personality and Social Psychology Bulletin*, **29**(5): 650–664.

Dasgupta, A. K., 1975: *The Economics of Austerity*. Oxford University Press, New Dehli, India.

Dasgupta, P. and K.-G. Mäler, 1991: *The Environment and Emerging Development Issues. Proceedings of the World Bank Annual Conference on Development Economics 1990*, Supplement to the World Bank Economic Review and the World Bank Research Observer.

Dasgupta, P., 1995: *An Inquiry into Well-Being and Destitution*. Clarendon Press, Oxford, UK.

Dasgupta, P. and K.-G. Maler, 1995: Povert, Institutions and the Environmental Resource Base. In *Handbook of Development Economics, Vol. Iii(a)*. J. Berhrman and T. N. Srinivasan (eds.), North Holland, Amsterdam, the Netherlands.

Dasgupta, P., 1997: Nutritional Status, the Capacity for Work, and Poverty Traps. *Journal of Econometrics*, **77**(1): 5–37.

Dasgupta, P., 2001: *Human Well-Being and the Natural Environment*. Oxford University Press, Oxford, UK.

DEFRA, 2008: *A Framework for Pro-Environmental Behaviours*. Department for Environment, Food and Rural Affairs (DEFRA), London, UK.

Deleder, N., 1994: Religious Contrasts in Consumer Decision Behaviour Patterns – Their Dimensions and Marketing Implications. *European Journal of Marketing*, **28**(5): 36–53.

Diamond, J., 1997: *Guns, Germs and Steel: The Fate of Human Societies*. W.W.Norton & Company, New York, NY, USA.

Dietz, T., G. T. Gardner, J. Gilligan, P. C. Stern and M. P. Vandenbergh, 2009: Household Actions Can Provide a Behavioral Wedge to Rapidly Reduce Us Carbon Emissions. *Proceedings of the National Academy of Sciences*, **106**(44): 18452–18456.

Dietz, T., 2010: Narrowing the US Energy Efficiency Gap. *Proceedings of the National Academy of Sciences*, **107**(37): 16007–16008.

Dindyal, S. and S. Dindyal, 2004: How Personal Factors, Including Culture and Ethnicity, Affect the Choices and Selection of Food We Make. *The Internet Journal of Third World Medicine*, **1**(2): 27–33.

Duchin, F., 1998: *Structural Economics: Measuring Changes in Technology, Lifestyle and the Environment*. Island Press, Washington, D.C., USA.

EC, 1999: *Council Regulation (Ec) No 1257/1999 on Support for Rural Development from the Eagff*. Official Journal of the European Communities L160 No 1257/1999, European Comission (EC), Brussels, Belgium.

ECEEE, 2006: *The European Commission Green Paper on Energy Efficiency or Doing More with Less*. European Council for an Energy Efficient Economy (ECEEE), Stockholm, Sweden.

Edwards, P. and A. Tsouros, 2006: *Promoting Physical Activity and Active Living in Urban Environments – the Role of Local Governments*. The Solid Facts, World Health Organization (WHO), Geneva, Switzerland.

Ehrlich, P.R. and J.P. Holdren, 1971: Impact of Population Growth. *Science*, **171**(3977): 1212–1217.

El Sarafy, S., 1989: The Proper Calculation of Income from Depletable Natural Resources. In *Environmental Accounting for Sustainable Development: A Undp & World Bank Symposium*. Y. Ahmed and S. SEl Sarafy (eds.), World Bank, Washington, D.C., USA.

Enevoldsen, M. K., A. V. Ryelund and M. S. Andersen, 2007: Decoupling of Industrial Energy Consumption and CO_2-Emissions in Energy-Intensive Industries in Scandinavia. *Energy Economics*, **29**(4): 665–692.

Entwistle, T. and S. Martin, 2005: From Competition to Collaboration in Public Service Delivery: A New Agenda for Research. *Public Administration*, **83**(1): 233–242.

Eshel, G. and P. A. Martin, 2006: Diet, Energy and Global Warming. *Earth Interactions*, **10**(9).

Esterlin, R. A., 1974: Does Economic Growth Improve the Human Lot? Some Empirical Evidence. In *Nations and Households in Economic Growth: Essays in Honor of Moses Abramowitz*. P. A. Davis and M. Reder (eds.), Academic Press, New York, NY, USA.

Faiers, A., M. Cook and C. Neame, 2007: Towards a Contemporary Approach for Understanding Consumer Behaviour in the Context of Domestic Energy Use. *Energy Policy*, **35**(8): 4381–4390.

FAOSTAT, 2008: *Consumption: Livestock and Fish Primary Equivalen*t. (accessed 1 December, 2008).

Fiala, N., 2006: *Estimates of US within Product Demand Elasticities for Meat*. Economic Research Service and United States Department of Agriculture, Washington, D.C., USA.

Frey, B. S. and A. Stutzer, 1999: Measuring Preferences by Subjective Well-Being. *Journal of Institutional and Theoretical Economics*, **155**(4): 755–778.

Frey, B. S. and A. Stutzer, 2000: Happiness, Economy and Institutions. *The Economic Journal*, **110**(466): 918–938.

Fung, T. T., M. J. Stampfer, J. E. Manson, K. M. Rexrode, W. C. Willett and F. B. Hu, 2004: Prospective Study of Major Dietary Patterns and Stroke Risk in Women. *Stroke*, **35**(9): 2014–2019.

Gardner, J. and P. Ashworth, 2006: *The Intelligent Grid Project: A Review of Relevant Literature*. Commonwealth Scientific and Industrial Research Organisation (CSIRO), Canberra, Australia.

Gardner, J. and P. Ashworth, 2008: Towards the Intelligent Grid – a Review of the Literature. In *Urban Energy Transition: From Fossil Fuel to Renewable Power*. P. Droege (ed.), Elsevier, Oxford, UK.

Geißler, R., 2002: *Die Sozialstruktur Deutschlands – Die Gesselschaftiliche Entwicklung Vor Und Nach Der Vereinigung*. Westdeutscher Verlag, Wiesbaden, Germany.

Gerbens-Leenes, P. W., S. Nonhebel and M. S. Krol, 2010: Food Consumption Patterns and Economic Growth. Increasing Affluence and the Use of Natural Resources. *Appetite*, **55**(3): 597–608.

Giddens, A., 1996: *Modernitet Og Selvidentitet*. Hans Reitzil, Copenhagen, Denmark.

Goodman, J., 2010: *High-Tech Growth and Low-Tech Sufficiency – Silences and Possibilities*. Draft working paper, Climate Actoin Research Group (CARG) Conference and Friends of the Earth, Australia, Canberra, Australia.

Groopman, J., 2004: *The Anatomy of Hope: How People Prevail in the Face of Illness*. Random House, New York, NY, USA.

Hamilton, K. and M. Clemens, 1999: Genuine Savings Rates in Developing Countries. *The World Bank Economic Review*, **13**(2): 333–356.

Hanley, N., J. F. Shogren and B. White, 1997: *Environmental Economics – in Theory and Practice*. Oxford University Press, Oxford, UK.

Harrison, C. and G. Davies, 1998: *Lifestyles and the Environment*. Environment & Sustainability Desk Study, The Economic and Social Research Council (ESRC), Swindon, UK.

Harvey, D., 1996: *Justice, Nature and the Politics of Difference*. Blackwell, Oxford, UK.

Hassaini, M. M., 1993: *Islamic Dietary Concepts and Practices*. Islamic Food & Nutrition Council of America, Park Ridge, IL, USA.

Herendeen, R. and J. Tanaka, 1976: Energy Cost of Living. *Energy*, **1**(2): 165–178.

Hubacek, K., and D. Guan and A. Barua, 2007: Changing lifestyle and consumption patterns in developing countries: A scenario analysis for china and India. *Futures* **35**(9): 1084–1096.

IUCN, 1980: *World Conservation Strategy: Living Resource Conservation for Sustainable Development*. United Nations Environment Programme (UNEP), World Wildlife Fund (WWF) and the International Union for Conservation of Nature (IUCN), Gland, Switzerland.

IPCC, 2007: Summary for Policy Makers. In *Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (Ipcc)*. B. Metz, O. R. Davidson, P. R. Bosch, R. Dave and L. A. Meyer (eds.), Cambridge University Press, Cambridge, UK and New York, NY, USA.

Jackson, T., 2005: *Motivating Sustainable Consumption – a Review of Evidence on Consumer Behaviour and Behavioural Change*. Report Preapared for the Sustainable Development Research Network, Centre for Environmental Strategy, University of Surrey, Surrey, UK.

Jensen, J. O., 2008: Measuring Consumption in Households: Interpretations and Strategies. *Ecological Economics*, **68**(1–2): 353–361.

Jørgensen, U., T. Dalgaard and E. S. Kristensen, 2005: Biomass Energy in Organic Farming – the Potential Role of Short Rotation Coppice. *Biomass and Bioenergy*, **28**(2): 237–248.

Kaenzig, J. and O. Jolliet, 2006: *Umweltbewusster Konsum: Schlüsselentscheide, Akteure Und Konsummodelle*. Umwelt-Wissen Nr. 0616, Bundesamt für Umwelt (BAFU), Bern, Switzerland.

Kahneman, D., P. P. Wakker and R. Sarin, 1997: Back to Bentham? Explorations of Experienced Utility. *The Quarterly Journal of Economics*, **112**(2): 375–406.

Kramer, K. J., H. C. Moll, S. Nonhebel and H. C. Wilting, 1999: Greenhouse Gas Emissions Related to Dutch Food Consumption – Foundations and Extensions. *Energy Policy*, **27**(4): 203–216.

Landes, M., S. Persaud and J. Dyck, 2004: *India's Poultry Sector – Development and Prospects*. Agriculture and Trade Report No. WRS-04–03, Market and Trade Economics Division, Economic Research Service, United States Department of Agriculture (USDA), Washington, D.C., USA.

Lawn, P. A., 2003: A Theoretical Foundation to Support the Index of Sustainable Economic Welfare (ISEW), Genuine Progress Indicator (GPI), and Other Related Indexes. *Ecological Economics*, **44**(1): 105–118.

Lenzen, M., 1998: Energy and Greenhouse Gas Cost of Living for Australia During 1993/94. *Energy*, **23**(6): 497–516.

Lenzen, M., C. Dey and B. Foran, 2004: Energy Requirements of Sydney Households. *Ecological Economics*, **49**(3): 375–399.

Limage, L. J., 2000: Education and Muslim Identity: The Case of France. *Comparative Education*, **36**(1): 73–94.

Lundgren, L. J., Ed. 1999: *Livssstil Och Miljö, Värderingar, Val, Vanor. Livsstil Och Miljö*. Swedish Environmental Protection Agency, Stockholm, Sweden.

Lyons, S., K. Mayor and R. S. J. Tol, 2007: *Convergence of Consumption Patterns During Macroeconomic Transition – a Model of Demand in Ireland and the OECD*. Working Paper No. 205, Economic and Social Research Institute, Dublin, Ireland.

Mann, N., 2000: Dietary Lean Red Meat and Human Evolution. *European Journal of Nutrition*, **39**(2): 71–79.

Masuda, T. and P. D. Goldsmith, 2010: *China's Meat Consumption: An Income Elasticity Analysis and Long-Term Projections*. Poster prepared for presentation at the Agricultural & Applied Economics Association Joint Annual Meeting, Denver, CO, USA.

Mennell, S., A. Murcott and A. H. Van Otterloo, 1992: *The Sociology of Food: Eating, Diet and Culture*. Sage Publicatoins Ltd., London, UK.

Millenium Ecosystem Assessment, 2005: *Ecosystems and Human Well-Being – Synthesis*. Island Press, Washington, D.C., USA.

Minx, J. C., T. Wiedmann, R. Wood, G. P. Peters, M. Lenzen, A. Owen, K. Scott, J. Barrett, K. Hubacek, G. Baiocchi, A. Paul, E. Dawkins, J. Briggs, D. Guan, S. Suh and F. Ackerman, 2009: Input–Output Analysis and Carbon Footprinting: An Overview of Applications. *Economic Systems Research*, **21**(3): 187–216.

Morse, J. M. and B. Doberneck, 1995: Delineating the Concept of Hope. *Journal of Nursing Scholarship*, **27**(4): 277–285.

Moser, S. C. and D. Dilling, 2007: Toward the Social Tipping Point: Creating a Climate for Change. In *Creating a Climate for Change – Communicating Climate Change and Facilitating Social Change*. S. C. Moser and D. Dilling (eds.), Cambridge University Press, Cambridge, UK.

Mullen, K., R. Williams and K. Hunt, 2000: Irish Descent, Religion and Food Consumption in the West of Scotland. *Appetite*, **34**(1): 47–54.

Muller, A., 2009: Sufficiency – Does Energy Consumption Become a Moral Issue? *IOP Conference Series: Earth and Environmental Science*, **6**(26): 262003.

Musaiger, A. O., 1993: Socio-Cultural and Economic Factors Affecting Food Consumption Patterns in the Arab Countries. *The Journal of the Royal Society for the Promotion of Health*, **113**(2): 68–74.

Namgyal, T. S. and T. Wangchuck, 1998: Measuring Gross National Happiness: A Predictive Model for Quantifying Social and Environmental Well-Being in Bhutan. *Sherub Doenme*, **4**(1&2): 1–24.

Narayan, D., R. Patel, K. Schafft, A. Rademacher and S. Koch-Schulte, 2000: *Voices of the Poor: Can Anyone Hear Us?* Pusblished for the World Bank, Oxford University Press, New York, NY, USA.

Niemeyer, S., 2004: Deliberation in the Wilderness: Displacing Symbolic Politics. *Environmental Politics*, **13**(2): 347–372.

Norgaard, R. B., 1984: Co-Evolutionary Development Potential. *Land Economics*, **60**(2): 160–173.

Nussbaum, M., 2000: *Women and Human Development*. Cambridge University Press, Cambridge, UK.

OECD, 1998: *Towards Sustainable Consumption Patterns – a Progress Report on Member Country Initiatives*. Organisation for Economic Co-operation and Development (OECD), Paris, France.

OECD, 2009: *The Role of Consumers and Corporations in Tackling Climate Change. Consumer Empowerment and Responsible Business Conduct*, Ethical Investment Research Services (EIRIS) for the Organisation for Economic Co-operation and Development (OECD), Paris, France.

Ojha, V. P., B. Pal, S. Pohit and J. Roy, 2008: *Social Accounting Matrix for India*. Working Paper no. GCP-JU-WP-2008–10–1, Global Change Programme, Jadavpur University, Jadavpur, India.

Oskamp, S., 2000: A Sustainable Future for Humanity? How Can Psychology Help? *American Psychologist*, **55**(5): 496–508.

Ozaki, R. and K. Sevastyanova, 2011: Going Hybrid: An Analysis of Consumer Purchase Motivations. *Energy Policy*, **39**(5): 2217–2227.

Pachauri, S. and D. Spreng, 2002: Direct and Indirect Energy Requirements of Households in India. *Energy Policy*, **30**(6): 511–523.

Pachauri, S., 2004: An Analysis of Cross-Sectional Variations in Total Household Energy Requirements in India Using Micro Survey Data. *Energy Policy*, **32**(15): 1723–1735.

Perrels, A. and C. L. Weber, 2000: *Modelling Impacts of Lifestyle on Energy Demand and Related Emissions*. VATT-Discussion Papers, Government Institute for Economic Research (VATT), Helsinki, Finland.

Pettinger, C., M. Holdsworth and M. Gerber, 2004: Psycho-Social Influences on Food Choice in Southern France and Central England. *Appetite*, **42**(3): 307–316.

Piasecki, B., and P. Asmus, 1990: In Search of Environmental Excellence: moving beyond blame. Simon and Schuster, New York, NY, USA.

Pimentel, D. and M. Pimentel, 2003: Sustainability of Meat-Based and Plant-Based Diets and the Environment. *The American Journal of Clinical Nutrition*, **78**(3): 660S-663S.

Ramírez, C. A., M. Patel and K. Blok, 2006: How Much Energy to Process One Pound of Meat? A Comparison of Energy Use and Specific Energy Consumption in the Meat Industry of Four European Countries. *Energy*, **31**(12): 2047–2063.

Rees, W. E., 1995: *Reducing the Ecological Footprint of Consumption.* Workshop on Policy measures for Changing Consumption Patterns, Seoul, South Korea.

Regmi, A., M. S. Deepak, J. L. Seale Jr. and J. Bernstain, 2001: Cross-Country Analysis of Food Consumption Patterns. In *Changing Strcuture of Global Food Consumption and Trade*. A. Regmi (ed.), Economic Research Service, United States Department of Agriculture Washington D.C., USA, pp. 14–22.

Reinders, A. H. M. E., K. Vringer and K. Blok, 2003: The Direct and Indirect Energy Requirement of Households in the European Union. *Energy Policy*, **31**(2): 139–153.

Roy, J., 2000: The Rebound Effect: Some Empirical Evidence from India. *Energy Policy*, **28**(6–7): 433–438.

Roy, J. and S. Pal, 2009: Lifestyles and Climate Change: Link Awaiting Activation. *Current Opinion in Environmental Sustainability*, **1**(2): 192–200.

Ruiter, R. A. C., C. Abraham and G. Kok, 2001: Scary Warnings and Rational Precautions: A Review of the Psychology of Fear Appeals. *Psychology & Health*, **16**(6): 613–630.

Ruiter, R. A. C., B. Verplanken, D. De Cremer and G. Kok, 2004: Danger and Fear Control in Response to Fear Appeals: The Role of Need for Cognition. *Basic and Applied Social Psychology*, **26**(1): 13–24.

Sack, D., 2001: *Whitebread Protestants – Food and Religion in American Culturew*. Palgrave, New York, NY, USA.

Saint-Blancat, C., 2004: La Transmission De L'islam Auprès Des Nouvelles Générations De La Diaspora. *Social Compass*, **51**(2): 235–247.

Salazar, A., S. Mohanty and J. Malaga, 2005: 2025 Vision for Mexican Chicken Consumption. *International Journal of Poultry Science*, **4**(5): 292–295.

Saunders, H. D., 2008: Fuel Conserving (and Using) Production Functions. *Energy Economics*, **30**(5): 2184–2235.

Sen, A. K., 1999: *Development as Freedom*. Oxford University Press, Oxford, UK.

Shatenstein, B. and P. Ghadirian, 1998: Influences on Diet, Health Behaviours and Their Outcome in Select Ethnocultural and Religious Groups. *Nutrition*, **14**(2): 223–230.

Shove, E., 2003: *Changing Human Behaviour and Lifestyle: A Challenge for Sustainable Consumption?* Department of Sociology, University of Lancaster, Lancaster, UK.

Sinha, R., A. J. Cross, B. I. Graubard, M. F. Leitzmann and A. Schatzkin, 2009: Meat Intake and Mortality: A Prospective Study of over Half a Million People. *Arch Intern Med*, **169**(6): 562–571.

Smil, V., 2002: Eating Meat: Evolution, Patterns, and Consequences. *Population and Development Review*, **28**(4): 599–639.

Smith, C., S. Hall and N. Mabey, 1995: Econometric Modelling of International Carbon Tax Regimes. *Energy Economics*, **17**(2): 133–146.

Sobel, M. E., 1981: *Lifestyle and Social Structure – Conceptions, Definitions and Analyses*. Academic Press, London, UK.

Srivastava, M., 2008: *Carbon Saved by Reducing Meat Consumption*. http://www.dothegreenthing.com/wiki/display/WIKI/Eat+less+meat+and+poultry (accessed 25 November, 2011).

Steenkamp, J.-B., 1993: Foor Consumption Behavior. In *European Advances in Consumer Research*. W. F. Van Raaij and G. J. Bamossy (eds.), Association for Consumer Research, Provo, UT, USA, 1, pp. 401–409.

Steptoe, A., T. M. Pollard and J. Wardle, 1995: Development of a Measure of the Motives Underlying the Selection of Food: The Food Choice Questionnaire. *Appetite*, **25**(3): 267–284.

Sterner, T., 2007: Fuel Taxes: An Important Instrument for Climate Policy. *Energy Policy*, **35**(6): 3194–3202.

UNDP, 1990: *Human Development Report 1990*. United Nations Development Programme (UNDP), New York, NY, USA.

UNDP, 2010: *Human Development Report 2010*. United Nations Development Programme (UNDP), New York, NY, USA.

Vandenbergh, M. P., P. C. Stern, G. T. Gardner, T. Dietz and J. Gilligan, 2010: Implmenting the Behavioral Wedge: Designing and Adopting Effective Carbon Emissions Reduction Programs. *Environmental Law Reporter*, **40**: 10547.

Vaughan, G. M., 1977: Personality and Small Group Behavior. In *Handbook of Meodern Personality Theory*. R. B. Cattell and R. M. Dreger (eds.), Academic Press, London, UK.

Vringer, K. and K. Blok, 1995: The Direct and Indirect Energy Requirements of Households in the Netherlands. *Energy Policy*, **23**(10): 893–910.

Wahlander, J., 2004: *Förutsättningar För En Minskning Av Växthusgasutsläppen Frånjordbruket*. Rapport 2004:1, Jordbruks Verket, Stockholm, Sweden.

Wakefield, M. A. and F. J. Chaloupka, 1998: Improving the Measurement and Use of Tobacco Control "Inputs". *Tobacco Control*, **7**(4): 333–335.

Walker, P., P. Rhubart-Berg, S. McKenzie, K. Kelling and R. S. Lawrence, 2005: Public Health Implications of Meat Production and Consumption. *Public Health Nutrition*, **8**(04): 348–356.

Wallén, A., N. Brandt and R. Wennersten, 2004: Does the Swedish Consumer's Choice of Food Influence Greenhouse Gas Emissions? *Environmental Science Policy*, **7**(6): 525–535.

Weber, C. L. and H. S. Matthews, 2008: Food-Miles and the Relative Climate Impacts of Food Choices in the United States. *Environmental Science & Technology*, **42**(10): 3508–3513.

Wilhite, H., H. Nakagami, T. Masuda, Y. Yamaga and H. Haneda, 1996: A Cross-Cultural Analysis of Household Energy Use Behaviour in Japan and Norway. *Energy Policy*, **24**(9): 795–803.

Wind, Y. and P. Green, 1974: Some Conceptual, Measurement and Analytical Problems in Lifestyle Research. In *Life Style and Psychographics*. W. D. Wells (ed.), American Marketgin Association, Chicago, pp. 97–126.

World Bank, various years: *The Little Green Data Book*. World Bank, Washington, D.C., USA.

Worldwatch Institute, 2010: *The State of the World 2010 – Transforming Cultures from Consumerism to Sustainability*. W.W. Norton & Company, New York, NY, USA.

Wrieden, W. L., A. S. Anderson, P. J. Longbottom, K. Valentine, M. Stead, M. Caraher, T. Lang, B. Gray and E. Dowler, 2007: The Impact of a Community-Based Food Skills Intervention on Cooking Confidence, Food Preparation Methods and Dietary Choices – an Exploratory Trial. *Public Health Nutrition*, **10**(02): 203–211.

Ziesemer, J., 2007: *Energy Use in Organic Food Systems*. Natural Resources Management and Environmental Department, Food and Argiculture Organisation (FAO), Rome, Italy.