

# Innovative solutions for averting a potential resource crisis—the case of one-person households in England and Wales

Jo Williams

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**Abstract** This paper seeks to test the hypothesis that growth in one-person households will increase the domestic consumption of energy, land and household goods in England and Wales. It concludes that if current consumer behaviour of one-person households persists there will be a significant increase in the consumption of all three resources in the future. However, it argues that many opportunities exist in England and Wales for tackling this problem. For example the new housing programme, increasing ability amongst one-person households to afford “green alternatives” and the search amongst some one-person households for alternative lifestyles (which could be potentially more resource efficient). The paper suggests that providing one-person households with opportunities to live in more resource efficient housing and adopt pro-environmental behaviour could significantly reduce their future environmental impact. Various design, fiscal and awareness-raising solutions are presented in the paper and their viability is assessed. These include ecological homes, collective housing forms, occupancy tax, relocation packages, educational programmes and targeted advertising campaigns. The paper proposes that using a combination of these more innovative solutions to the problem could significantly reduce the future environmental impact of one-person households.

**Keywords** Household size · One-person households · Domestic resource consumption · Housing · Ecological development

## 1 Introduction

There is a growing body of evidence to suggest that growth in one-person households could have a detrimental impact on the future environment. The research suggests that this demographic trend could potentially lead to an increase in domestic

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Jo Williams (✉)  
The Bartlett School of Planning, University College London, Wates House 22,  
Gordon Street, London WC1H 0QB, UK  
e-mail: joanna.williams@ucl.ac.uk

resource consumption (energy, water, land and materials), production of domestic waste products (solid waste and carbon emissions) and loss of biodiversity (examined in Section 4). Growth in one-person households increases demand for housing units and associated services. Those living alone use resources less efficiently than larger households. Increase in affluence amongst one-person households will almost inevitably increase resource consumption. Based on these three factors alone, it is likely that growth in one-person households will increase resource consumption and waste production in the future.

The paper seeks to test the hypothesis that growth in one-person households will increase the domestic consumption of energy, land and household goods through statistical analysis of national data for England and Wales<sup>1</sup>. The analysis investigates the impact of household size, socio-economic and design variables on the consumption of these three resources, in order to determine the relative importance of household size. The impact of changes in the socio-economic characteristics of the group on the consumption of land, energy and household goods is also analysed (Section 4).

However, there are many potential opportunities for reducing the environmental impact of one-person households. The programme for new housing development in England and Wales provides a chance to develop more innovative housing forms that could reduce resource consumption (e.g., ecological homes and collective housing forms). In existing housing stock there is also capacity for reallocation of units that will help to reduce resource inefficiencies, particularly in terms of land consumption. Increasing affluence amongst one-person households may be advantageous as it may enable the group to consume more resource efficient products and services in the future. Preference amongst some one-person households (“regretful loners”) for greater sociability may also provide an opportunity to encourage resource sharing.

The paper argues that providing one-person households with opportunities to live in more resource efficient housing and adopt pro-environmental behaviour could reduce their future environmental impact. Various design, fiscal and awareness-raising solutions were assessed (Section 6). Three design solutions were considered: ecological homes, communal and collaborative housing. The design solutions were discussed with developers<sup>2</sup> (Williams, 2003 unpublished). The feasibility of constructing these more innovative housing forms and possible levers for change

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<sup>1</sup> A statistical analysis of data was completed to determine the socio-economic (age, socio-economic grouping, income, tenure, qualifications, marital status, gender, household size) and design factors (type of dwelling, age of dwelling, floor space, glazed area, level of insulation, provision of communal facilities) influencing domestic consumption of energy, land and goods (per capita) and the relative importance of household size. Multiple regression analysis was used to determine the inter-relationships between variables. The data used was from the Family Expenditure 1991 Survey (Office of National Statistics, 1992) and Energy Supplement of the English Housing Conditions Survey 1991 (DETR, 1997). The findings and methodology are reported in Williams (2003 unpublished).

<sup>2</sup> A focus group, face-to-face interviews, and a questionnaire survey were used to collect developers’ responses to a number of questions relating to the feasibility and potential markets for a variety of innovative housing solutions. They were also asked to consider how fiscal and educational approaches in combination with targeted advertising could support new housing forms. A diverse selection of developers were involved in the discussion including social housing providers, volume house builders and those involved with pioneering housing projects.

were considered. Developers also briefly explored the market potential for ecological homes amongst one-person households.

A focus group of one-person households was also convened<sup>3</sup> to discuss the market potential for collaborative and communal housing options (Williams, 2003 unpublished). In addition a survey of one-person-households living in a collaborative form of housing<sup>4</sup> (cohousing) was completed to identify the factors influencing their choice (Williams, 2003 unpublished). Both sets of primary data were then used to determine the market potential for communal and collaborative housing amongst existing and potential one-person households.

The focus group consisting of one-person households were asked to consider what approaches encourage pro-environmental behaviour particularly in terms of energy and space consumption (Williams, 2003 unpublished). Two fiscal approaches were considered by the group—occupancy tax and relocation package—as methods for encouraging more efficient use of space amongst one-person households. The value of an educational programme and targeted advertising to encourage more pro-environmental behaviour and consumer choices amongst one-person households were also discussed. The value of these approaches in helping to create demand for the more innovative housing forms (previously discussed) was also considered by the developers.

The paper begins with a description of current and future demographic trends, the emerging characteristics of one-person households and an explanation of the key drivers for the resulting patterns.

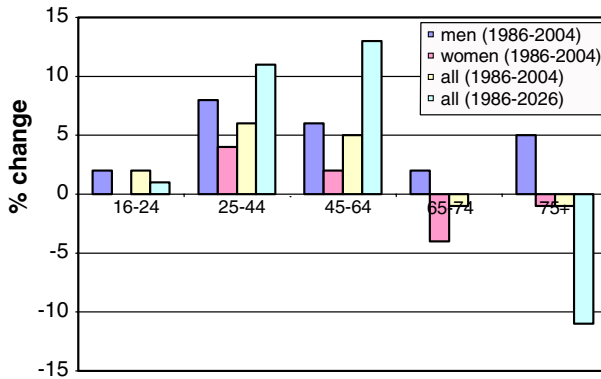
## 2 The household explosion

In the UK the number of one-person households has grown significantly. Between 1971 and 2001 there was a 12% shift from 18% of households in 1971 rising to 30% in 2001 (6.5 million households—Census 2001). The projected increase in households in England of 4.8 million from 2003 to 2026 is equivalent to an average annual growth of around 209,000. Over the period from 2003 to 2026, this represents about 23% growth. One-person households are expected to account for 72% of that annual growth (ODPM, 2006). This corresponds to a rise from 32% to 38% of the total number of households (ODPM, 2006). Thus current and predicted future growth of one-person households in the England and Wales is significant.

Historically those forming one-person households have tended to be pensioners (the majority female and widowed) and single men aged 25–29 (Strode, 1996). Currently almost 50% of one-person households are pensioners, 75% of these are women (ODPM, 2006, Fig. 1). The fastest growth in one-person households currently is amongst those aged 25–44 (ODPM, 2006, Fig. 1) and more particularly amongst single never-married men aged 35–44 (Hooper, Dunmore, & Hughes, 1998). Thus the age and gender characteristics of the group appear to be changing.

<sup>3</sup> The focus group was representative of the broad range of socio-economic characteristics amongst one-person households. It did include representatives from the growth and largest groups i.e. over 60's, single never-married males 35–44 years old and widows. There “regretful loners” and “happy independents” were both represented in the group.

<sup>4</sup> Survey of one-person cohousers was completed using a combination of interviews and written surveys to determine the factors influencing their choice to live in cohousing and the benefits accrued in the UK and USA. The findings and methods used were reported in Williams, 2003 (unpublished).

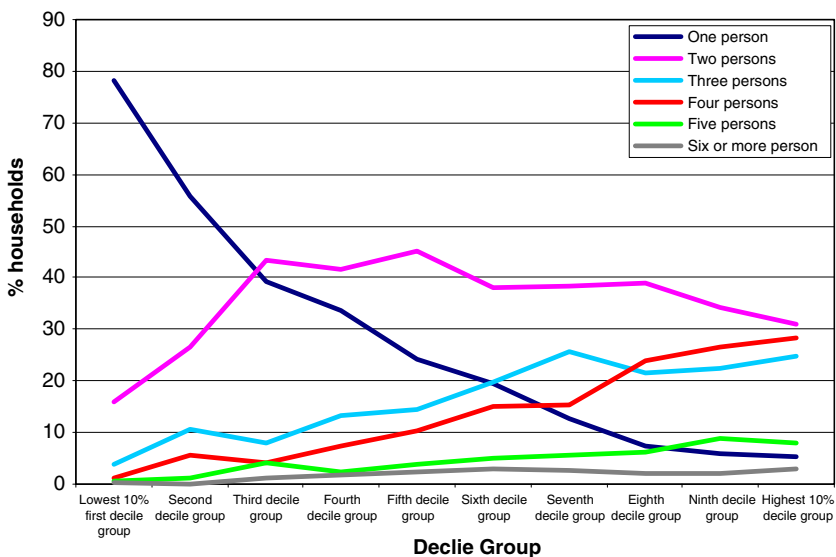


**Fig. 1** Percentage change in one-person households 1986–2026 (by age and gender) Source: Historical figures from Summerfield and Gill (2005); projections from ODPM (2006) and GAD (2005). Note projections for 2026 are only for England and not by gender due to data limitations

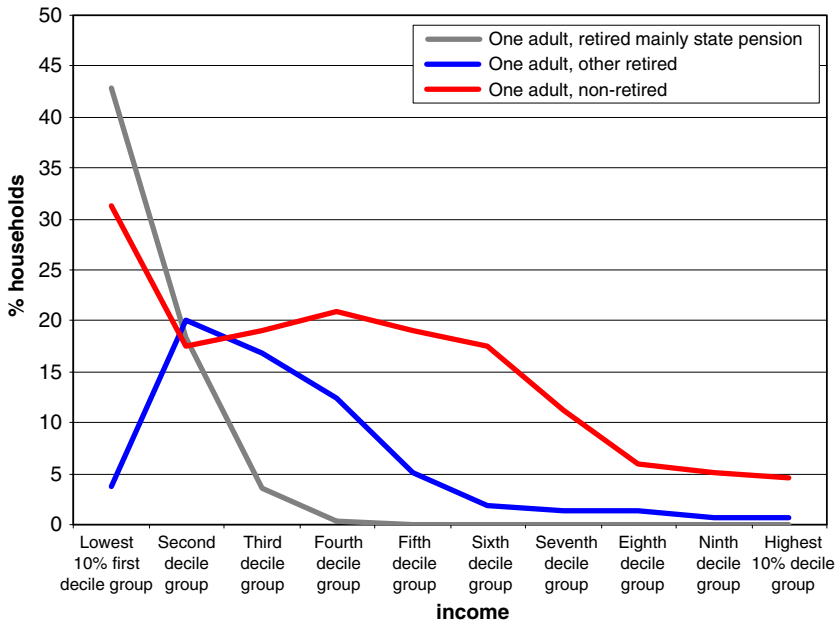
Household projections to 2026 suggest that there will continue to be an increase in both male and female one-person households of working age (25–64 years) and a decline in those aged over 75 years (Bennett and Dixon, 2006).

Currently the majority of one-person households are in the lowest income deciles (Office of National Statistics, 2003, Fig. 2), as most are retired and receiving only a state pension. When compared to larger households, one-person households are in the lowest income deciles.

However, growth in the number of retired one-person households with other forms of pension and working age one-person households suggests that the group’s income characteristics will become more diverse in the future (Fig. 3). Those one-person pensioners receiving a non-state pension and working one-person



**Fig. 2** Relative affluence of households of differing size 2001–2002. Source: ONS, Family Spending 2001–2002



**Fig. 3** Relative affluence of one-person households 2001–2002 by retired status. *Source:* ONS, Family Spending 2001–2002

households are more economically diverse and are represented in the higher deciles. Thus growth in both these groups is also likely to result in an overall increase in affluence amongst one-person households up to 2026.

Living alone is also becoming a more permanent lifestyle option, particularly amongst men (Bennett & Dixon, 2006). In fact 14.2% of men aged 25–34 living alone in 1971 were still living alone 1981, but 28% of men in this age bracket who lived alone in 1981 were still living alone in 1991 (Bennett & Dixon, 2006). Taking the population as a whole, less than half those who start living alone will ever live with other people again (Chandler, Williams, Maconachie, Collett, & Dodgeon, 2004; Smith, Wasoff, & Jamieson, 2005). This contrasts with previous cohorts for whom living alone was viewed as a more temporary living arrangement.

The emergence of two distinct groups amongst one-person households has also been reported (Bennett & Dixon, 2006; Hooper et al., 1998). These groups are “happy independents” (elective singles) and “regretful loners” (forced singles). The former group are one-person households who have chosen solo living, and the latter group are those who have been constrained to this lifestyle by circumstance (Bennett & Dixon, 2006). Happy independents tend to be younger, financially independent and affluent whilst “regretful loners” tend to be older and less affluent. The latter may seek lifestyle alternatives that provide them with greater opportunities to socialise, security and affordability, whilst the former enjoy living alone and are prepared to pay a premium to do so.

Currently in England and Wales there is rapid growth in one-person households, which is predicted to continue until at least 2026. The group is becoming more diverse and amongst some at least the lifestyle option is more permanent. Current and future socio-economic trends also suggest that one-person households are likely

to become more affluent in the future. Increase in the number of one-person households, their affluence and the permanency of living alone may result in a long-term increase in the resources consumed by the group.

### 3 Drivers for growth

There are numerous drivers for the growth in one-person households in England and Wales. Since the sixties there has been the rise of the primary individual (described by Santi, 1988) reflecting the post-modern individualistic culture (Harvey, 1989). Living alone has thus become both desirable and culturally acceptable (Hall, Ogdén, & Hill, 1997). This has created a preference for the independence and autonomy of adulthood without the responsibilities of marriage and parenthood (Goldschieder & Waite, 1991), which has led to the demise of the nuclear and extended family and the rise of unmarried, divorced, childless individuals (Hall et al., 1997; Kaufman, 1994; Roussel, 1983).

In real terms this has resulted in an increase in single never-married, divorced and separated one-person households particularly in the young and middle-age groups. Young people are leaving home earlier (particularly those completing tertiary education), often forming one-person households. Later marriages amongst the group have extended the period that they remain living alone. Higher divorce rates and low re-marriage rates amongst middle-age groups has increased the number of middle-aged one-person households. Improvements in living standards and health have led to growth in the number of retired one-person households (Hall et al., 1997). These generally tend to be women who have lost their partner (Evandrou, Falkingham, Rake, & Scott, 2001), although this may shift in the future as health care improves, male longevity increases and of living alone becomes more popular amongst men.

Economic drivers have also encouraged the formation of one-person households. Most apparent is the impact of increasing wealth. People's economic capability to live alone plays a fundamental role. For example, increase in income support for the elderly in the USA accelerated the formation of one-person households in older age groups (Joint Centre for Housing Studies Harvard, 2002). In England and Wales, growing numbers of women in the workforce has increased their affluence and economic independence and resulted in growth of female one-person households (Hall et al., 1997; Hammett, 1994). Changes in the labour market (globalisation in particular) has created temporary and permanent one-person households, due to the spatial distribution employment opportunities and the fluidity of the labour force. It has also led to an increase in married one-person households (Hall et al., 1997).

The housing market and availability of affordable accommodation has also influenced the formation of one-person households. For example, in England and Wales in the eighties rapidly rising house prices and relaxation of mortgage lending encouraged young people to get on the housing ladder earlier which led to the formation of younger one-person households (Select Committee on Environment Transport and Regional Affairs, 1998). In Scandinavia, Netherlands and Germany low-cost rental accommodation also encouraged young people to leave home, forming one-person households at an earlier age. For example, over 40% of the new one-person households in West Germany are formed by young people leaving the parental household (Witte, 1988). In contrast in the USA only 25% of the new

one-person households are formed in this way, at least in part due to lack of affordable accommodation (Witte, 1988).

The “predict and provide” approach to housing supply adopted in England and Wales has also appeared to reinforce the formation of one-person households. By predicting a growth in small households and providing units to meet the demand rather than accommodation that encourages alternative living arrangements (and larger households). This policy approach has encouraged the formation of one-person households (Hall et al., 1997). Thus a combination of behavioural, health, economic, employment factors and housing policy have led to this increase in one-person households in England and Wales.

In the next section the potential environmental impact of the growth in one-person households in England and Wales is discussed.

#### 4 The potential consumption crisis

Evidence suggests that increase in one-person households is likely to have a detrimental environmental impact (Table 1). The impact of changing demography on the environment has been widely studied (Holdren & Ehrich, 1974; Lui, Daily, Ehrich, & Luck, 2003). More particularly the link between declining household size, diminishing biodiversity, increasing domestic energy consumption, carbon dioxide emissions and household waste.

Lui et al. (2003) completed a global study to determine the impact of declining household size on biodiversity and natural resources. It demonstrated that a rapid increase in household numbers fuelled by changing household dynamics would manifest itself as urban sprawl and result in higher per capita resource consumption in smaller households posing a serious challenge to biodiversity and conservation (Lui et al., 2003). The study found that more households would require more housing units (thus increasing land and materials needed for construction) and smaller households were less efficient in terms of resource use per capita than larger households. Increasing consumption of resources would also lead to a reduction in biodiversity through the loss of habitats and species.

Further research supported the proposition that smaller households were less resource efficient than larger households. One study (International Consumer Protection and Enforcement Network, 2001) used UK data to determine how household size influenced consumption of goods, packaging and indirect energy. It demonstrated an inverse relationship between the weight of items consumed by a household and household size. It showed that one person living in a large household (defined as being 4 or more persons) on average consumed 1,000 kg of products per capita annually, whilst 1,600 kg were consumed by a one-person household over the same time period (i.e., 60% more).

The study also investigated the relationship between household size and quantity of packaging consumed and found an inverse relationship. Four person households consumed 70 kg per capita and one-person households consumed 120 kg per capita annually (i.e., 70% more). The INCPEN (2001) study investigated how weight of products and packaging consumed per person throughout the supply chain altered with household size. It found that the quantity of products and packaging consumed per person increased as household size decreased. Thus there appeared to be an inverse relationship between waste production and household size (if the quantity of

**Table 1** The environmental impact of growth in one-person households—a summary

Resource	Impact of increase in one-person households	Reference
Construction materials	Increase in number of dwellings—increase in use of construction materials	Lui et al. (2003)
Land	Increase in one-person households—increase in land consumed for dwellings	Lui et al. (2003)
Habitats	Increase in one-person households—increase in land and materials consumed for dwellings—loss of habitats	Lui et al. (2003); Cincotta and Engelman (2000a) Cincotta, Wisniewski, and Engelman(2000b); An et al. (2001); Dompka (1996); Yousif (1995)
Species	Increase in one-person households—increase in land and materials consumed for dwellings—loss of habitats—loss of species	Lui et al. (2003); Cincotta and Engelman (2000a) and Cincotta et al. (2000b) An et al. (2001); Dompka (1996); Yousif (1995)
Household goods	Inverse relationship between household size and the weight of items consumed per capita.	ICPEN (2001)
Packaging	Inverse relationship between household size and quantity of packaging consumed per capita.	ICPEN (2001)
Indirect energy consumption.	Inverse relationship between household size and the indirect energy consumed per capita.	ICPEN (2001)
Direct energy consumption	Inverse relationship between household size and direct energy consumption per capita.	Fawcett et al. (2002); Noorman and Uiterkamp (1998); Roy and Caird (2001); Kaul and Liu (1992); Ironmonger, Aiken, and Erbas (1995); Durrenberger, Patzel, and Hartmann (2001)
Carbon Emissions	Inverse relationship between household size and carbon emissions per capita.	Fawcett et al. (2002) and Noorman and Uiterkamp (1998); MacKellar, Lutz, Prinz, and Goujon (1995)

products and packaging consumed was directly proportional to quantity of waste produced—confirmed by research completed by Noorman & Uiterkamp, 1998 using UK data).

There was also an inverse relationship between indirect energy consumption and household size. The INCPEN research found that one person living in a large household in the UK consumed 80 GJ per capita annually whilst one-person households on average consumed 190 GJ per capita (i.e., 138% more). Research also showed an inverse relationship between direct energy consumption, carbon emissions and household size in the UK (Fawcett, Hurst, & Boardman, 2002; Noorman & Uiterkamp, 1998). Table 2 summarises numerically the impact of household size on household resource consumption and waste production patterns.

From the data presented it seems that an increase in one-person households could potentially have a significant impact on the UK environment in terms of the consumption of land, energy and materials; the production of solid waste and carbon emissions; and the loss of biodiversity.

A more detailed statistical analysis of data (Williams, 2003 unpublished) was completed to determine the relationships between household size and the consumption of energy, land and household goods per capita in England and Wales. The relative importance of household size as a variable effecting the consumption of land, energy and household goods when compared with other socio-economic (age, socio-economic grouping, income, tenure, qualifications, marital status, gender) and design variables (type of dwelling, age of dwelling, floor space, glazed area, level of insulation) was also investigated. A final analysis was then completed to determine how the changing characteristics of the group would impact on future consumption patterns.

The first stage of the analysis confirmed the inverse relationship between household size and domestic energy consumption (gas and electricity) per capita. It showed that one-person households consumed between 23% and 77% more electricity and 38–54% more gas than two or four person (all adult) households per capita respectively. It also demonstrated an inverse relationship between the quantity of space (land) consumed per capita and household size. It showed that one-person households consumed between 45% and 65% more space than two or four person (all adult) households per capita respectively.

The second stage of the analysis found that four key factors influenced energy consumption per capita: housing design (particularly floor area and insulative capacity), income, age of occupants and household size. Design and income variables were found to be the key factors influencing energy consumption, whilst household

**Table 2** Effects of household size on the consumption of energy, materials and production of waste annually per capita (one-person household = 100)

	1 Person	2 Persons	4 Persons	Data source
Products per capita	100	75	62.5	INCPEN
Packaging per capita	100	75	58	INCPEN
Indirect energy per capita	100	63	42	INCPEN
Electricity per capita	100	68.5	45	Noorman and Uiterkamp
Gas per capita	100	64.5	39	Noorman and Uiterkamp
Solid waste per capita	100	88.5	75.5	Noorman and Uiterkamp

Source: Compiled using data from INCPEN (2001), Noorman and Uiterkamp (1998)

size appeared to have the least influence of the four variables. Household size and income appeared to be the key determinants of land consumption per capita. In this instance household size appeared to be a more significant factor influencing land consumption than income. Income was the key factor influencing expenditure on household goods per capita, but household size still appeared to have some limited effect.

Design and income are crucial factors influencing resource consumption (per capita). Household size also appears to influence the consumption of the three resources studied, but for energy and goods to a far lesser extent. Resource savings in larger households are undoubtedly made through the sharing of space and goods amongst the household, which also enables energy savings (per capita) in space heating and appliance use. It is also important to highlight that income influences consumption of all three resources studied. Thus rise in affluence amongst one-person households is likely to result in an increase in consumption of all three resources.

The third stage of the analysis was completed to determine how the changing composition of the group might affect the consumption of energy, land and goods in England and Wales. Those aged over 60, widows and single never-married males aged 35–44 were studied. The analysis found that single never-married males aged 35–44 were likely to consume the most energy, land and household goods per capita of the groups studied (Table 3). This group consumed consistently more than the average for one-person households.

These results are most likely explained by higher income amongst the group and thus greater ability to consume more goods, energy and live in more spacious accommodation. Widows consumed less energy, spent less on household goods and lived in less spacious accommodation than the other groups studied. Again this is likely to reflect lower income amongst the group. The consumption patterns of those aged over 60 were consistent with the average for one-person households. Presumably this is because the group makes up the majority of one-person households.

There are two implications of these findings for future consumption of land, goods and energy for one-person households in England and Wales. Firstly that an increase in single never-married males aged 35–44 is likely to result in an increase in the consumption of the resource specified. Secondly that as income amongst one-person household increases, if current preferences persist, there will be a commensurate increase the consumption of land, energy and goods per capita. However, the environmental impact of growth in these more affluent households may be lessened

**Table 3** Comparison of resource consumption (per capita) amongst one-person households

	Average one-person household	Male single, never-married, 35–44	60+	Widowed	Single never-married
Annual energy consumption per capita (kwh)	14,197	16,073	14,175	13,380	7,868
Floor space per capita (sqm)	67	72	68	62	28
Weekly expenditure on household goods per capita (£)	25	25	18	19	25

Source: Williams, 2003 (unpublished)

if increase in income is accompanied by changing preferences for more space and energy efficient housing, recycled, durable or environmentally friendly goods.

Durning (1992) argues that increasing affluence will result in “greener” consumption as households buy more environmentally friendly products. Rothman (1998) argues that there is no evidence to support this suggestion and that consumption will continue increase as affluence grows. Ropke (2001) suggests that patterns of consumption will alter as affluence increases and that the share of spending will switch from food (in lower income groups) to housing and transport (in higher income groups). This was supported by the analysis conducted by Williams (2003 unpublished—Table 3) which showed that single never-married one-person households (who tended to be less affluent than the other groups studied, the majority being unemployed, on a state pension or in full-time education) tended to consume considerably less space and energy but spent more on household goods than the other more affluent groups.

The findings from the research conducted by Williams, Rothman and Ropke suggest that if affluence amongst one-person households increased, the group’s spending on resources (and more especially housing and energy) is also likely to increase. However more research is needed to determine the environmental outcome of increasing affluence amongst the group. It should be noted that increase in domestic resource consumption linked with increase in affluence could be seen in households of all sizes.

Overall these findings suggest that the impact of growth in one-person households (particularly as affluence increases amongst the group) on land, energy and good consumption will be significant at least until there are considerable changes in consumer choices. The inefficiencies of living alone combined with increase in demand for new accommodation will result in an increase in resource consumption (especially land and energy). Thus the drivers that need to be tackled are the formation of one-person households, their efficiency and consumption choices. In the next section we investigate the current economic, regulatory, design, technological and educational instruments for tackling efficiency, formation and consumer choices.

## 5 Current situation in England and Wales

The Government (for England and Wales) recognises the link between increase in one-person households and increase in domestic energy (Department of Trade and Industry, 2004) and land consumption (Environment Agency; 2004), green house gas emissions (Department of Trade and Industry, 2004) and waste production (Enviros Consulting Limited, 2004). However, the Government does not seek to deal with resource consumption amongst one-person households directly (thereby increasing the resource efficiency of one-person households or encouraging the consumption of “greener” alternatives) or indirectly (by discouraging the formation of one-person households or encouraging communal<sup>5</sup>/collaborative<sup>6</sup> living arrangements).

<sup>5</sup> Communal lifestyle includes any form of household where resources are shared between household members (who may be related or non-related).

<sup>6</sup> Collaborative lifestyles are where households share resources within a community (e.g., cohousing).

## 5.1 Economic

To an extent the cost of resources (energy, goods and housing) restricts consumption. Land, property and energy prices in the UK are currently high. This has meant households opt to live in and developers build more space and energy efficient property. Increasing energy price is also beginning to encourage greater efficiency and diversification of energy sources. Rising property and energy prices may also constrain growth in one-person households, forcing low-middle income groups to search for alternative, more affordable living arrangements (e.g., sharing accommodation with friends or family).

Conversely household goods are relatively inexpensive. The economic value of many goods does not reflect the environmental costs of production and transportation. Similarly the cost of disposing of the waste generated by the consumption of household goods does not reflect volume or environmental impact. Thus, the environmental costs of consumption need to be better reflected in the price of goods and waste disposal. This may increase the economic viability of currently more expensive “green goods” and encourage greater reuse, recycling and recovery of resources amongst households.

“Green” alternatives tend to be more expensive and less easily available to consumers because the market for these products is as yet undeveloped. The government does subsidise renewable energy generation (for example using the Renewables Obligation, capital grants schemes, and a variety of other smaller grants) and supports markets for recycled materials. However the domestic market for these resources is still limited by both inadequate supply and demand. In addition to increasing the cost of environmentally damaging products (so that the price reflects the environmental impact), regulation could be used to help to stimulate demand and supply of “green” alternatives. Increasing affluence amongst one-person households suggests that the group will have the means to buy “green” products if they are readily available. Raising awareness amongst the group of the “green” options available to them and their benefits would also help.

Government subsidies have been used to encourage greater domestic resource efficiency. One example is the subsidy to encourage the installation of new energy efficient technology in the homes of low-income households, part of the Decent Homes and Warm Front programmes. Another example is the relocation package offered in the social housing sector to encourage smaller households to move to smaller accommodation (thus encouraging greater space efficiency and energy efficiency). These subsidies are economic enablers that tend to be targeted at low-income groups. Similar incentives are not offered to higher income groups, yet resource efficient behaviour needs to be incentivised for all groups regardless of income.

## 5.2 Regulation

Domestic resource efficiency is also regulated by legislation, policy and targets. Legislation controlling the quantity of waste going to landfill (Council Directive, 1999/31/EC), carbon emissions (Council Directive 2003/87/EC; Great Britain, 2003) and land use (Great Britain, 2004) all impact on domestic resource efficiency. The Building Regulations (Great Britain, 2002) also encourage the development of more energy efficient housing units. The amendments to the regulations introduced in

April 2006 have increased requirements for energy efficiency and incorporated recommendations for inclusion of micro renewable energy technologies into new build or refurbishments. The Strategic Environmental Assessment Directive (2001/42/EC) ensures that environmental objectives (including more efficient use of domestic resources and reduction in domestic waste going to landfill) are considered in strategic development proposals (for example the development of large housing schemes).

In England and Wales government policies reflect a preference for recycling (e.g. waste and land), re-use (waste and land), recovery (energy) of resources or use of renewable resources (energy) rather than minimisation through the introduction of consumption controls (as it might slow economic growth and reduce international competitiveness). This is demonstrated in the waste, energy strategies and planning policy guidance. General targets have been set to reduce municipal waste going to land fill (Council Directive 1999/31/EC) and greenhouse gas emissions from all sectors (Council Directive 2003/87/EC; Great Britain, 2003). The Government has also set targets for the domestic sector, for reducing carbon consumption and increasing waste recycling (DETR, 2000a; Great Britain, 2003).

The ecohomes rating (developed by the Building Research Establishment 2006) has encouraged greater energy efficiency in the construction and operation of domestic buildings. The rating measures homes based on the following criteria: energy; water; pollution; materials; transport; ecology and land use; health and well-being. The rating scheme is likely to be replaced by the sustainable homes code (DCLG, 2006) that seeks to encourage greater resource efficiency (particularly for energy and materials) and the use of more sustainable resource alternatives (e.g., renewable energy sources) in both construction and operational processes in new homes. Both the ecohomes rating and the sustainable homes code have set higher environmental standards for new homes than existing Building Regulations, but neither have statutory status so currently only act as aspirational targets for developers. In addition the standards only apply to new homes. Thus existing building stock remains unaffected.

Neither the rating nor code addresses the efficient use of land for new homes. However, Planning policy guidance (DETR, 2000b) has set a target for the provision of 60% of all new housing units on brownfield sites or through the recycling of existing properties. This policy protects green field sites and may reduce the consumption of materials and production of construction waste through the recycling of buildings. The Government also supports increasing residential densities to between 30 and 50 dwellings per hectare net. Increasing residential densities reduces land consumption and increases energy efficiencies. However, minimum size standards for accommodation (that could be used to encourage optimal space efficiency in new build homes) do not currently exist.

### 5.3 Design and technology

There has been some innovation in house building since the mid 1990's in the UK driven by regulatory change (e.g., the Building Regulations), new market conditions and standards, especially in social housing. Much of this has been stimulated by government initiatives following the Egan Report (DETR, 1998), the establishment of the Housing Forum and its demonstration projects programme and more recently

moves to increase the level of off-site prefabrication, promoted by the Office of the Deputy Prime Minister.

Speculative house builders are now beginning to incorporate energy efficient design (and in some instances renewable energy technology) into new housing developments. Regional and local planning authorities setting energy efficiency and renewable energy targets for large-scale new housing projects are encouraging this. It is particularly effective in areas where large-scale developments are planned (e.g., Thames Gateway) and the local and regional authorities prioritise energy efficiency and renewable energy (e.g., Greater London Authority, East of England Regional Authority).

However, there is still limited innovation in the house building industry (particularly in smaller developments) largely driven by the need for developers to maintain or increase their profit margins. The cost of new technology and design features reduces the extent to which developers are prepared to consider the environmental impact of housing throughout its lifecycle (Smith, Whitelegg, & Williams, 1998). Additional requirements for affordable housing, infrastructural improvements, and open space in new housing developments generally take priority over environmental design features in the planning process. This also reduces the stimulus for innovation in housing design.

Housing units themselves are increasingly designed to be more space efficient. However the supply of housing stock does not fit demand and as a result it is less efficient. Over-supply in private sector of units for larger households means that smaller households are living in properties too large for their needs. Conversely, there is very limited demand for one-bed and studio flats in the social sector and consequently there is an over supply of small units, which are often left vacant (ODPM, 2000). This mismatch between supply and demand could be addressed to reduce under-occupancy and the inefficient use of space and energy in existing stock.

The predict and provide approach to housing development reinforces existing lifestyle choices and thus generates one-person households. Providing accommodation options that permit or encourage new lifestyle choices may help to overcome this. For example, a trend towards the formation of non-family households has been emerging since the 1970's in Great Britain (Hall et al., 1997; Roussel, 1983; Santi, 1988; Wall, 1989). In fact there has been an estimated increase from 1961 to 1991 of 13% (from 17% in 1961 to 30% in 1991 according to Hall et al., 1997). Encouraging potential one-person households to live in larger groups could significantly reduce household resource consumption.

The emergence of “regretful loners” creates a possible market for alternative living arrangements, that could be provided by communal<sup>7</sup> and collaborative<sup>8</sup> housing designs (collective housing designs<sup>9</sup>). Communal and collaborative lifestyles offer the opportunity for socialise in secure environments that could be very attractive to “regretful loners”. In addition, encouraging people to live communally or collaboratively enables space, energy, and goods to be shared within households or communities (Meltzer, 2000 unpublished PhD Thesis; Williams, 2005a, b).

<sup>7</sup> Communal living—unrelated individuals live together as a household within the same unit (e.g., peer shared households).

<sup>8</sup> Individual households living separately in a community but sharing communal living facilities (space, energy, goods); chores, expertise, etc (e.g., cohousing).

<sup>9</sup> Collective housing designs is the collective term for collaborative and communal designs.

New resource efficient housing designs for the luxury market are also needed, particularly as affluence amongst one-person households increases. Some pioneering developers have already begun to build ecological homes for the luxury market (for example Countryside Homes-Greenwich Millennium Village). More demonstration projects are beginning to appear in the UK, generally where there is some financial support from government, developers' profit margins are substantial, or planning authorities place conditions on the development. The intention is to role-out this type of development nationally, although problems with supply chains and residents modifying their units have already been encountered.

#### 5.4 Education

National educational programmes (particularly to encourage recycling and energy efficient behaviour) and advertising campaigns (recycling and global warming) to raise awareness amongst professionals and the public of environmental problems and ways to tackle these problems have been implemented. Local programmes including Local Agenda 21 (organised by local authorities and the public) and *Ecoteams* (organised by Global Action Plan) have also been used to support environmental projects and develop pro-environmental behaviour at a local level.

Programmes have tended to ignore key issues such as increasing consumption of domestic goods and preference for spacious living accommodation. Advertising campaigns to promote more environmentally friendly products renewable energy, ecological homes, recycled and energy efficient materials have also been very limited to date. This is an approach that could be developed to encourage "green" consumer choices. Currently there are no advertising campaigns to promote communal or collaborative lifestyles. Nor are there educational programmes specifically designed to encourage pro-environmental behaviour amongst one-person households. Educational programmes and advertising campaigns could be used to tackle all of these issues.

### 6 A time for change

This problem can be tackled in two ways either by encouraging one-person households to become more resource efficient (adopt pro-environmental behaviour and live in resource efficient homes) or by slowing the growth of one-person households. There are several factors working in favour of both options:

1. A significant proportion of future one-person households are likely to live in new (rather than existing) housing stock. This provides an opportunity to accommodate them in housing built to higher environmental standards—ecological homes—which should help to increase their resource efficiency in the future.
2. The increase in the cost of living alone (particularly accommodation and energy costs) is likely to slow the growth in one-person households and encourage the less affluent in the group to seek out alternative living arrangements (perhaps communal or collaborative lifestyles).
3. The "regretful loners" or "forced singles" (who form a significant subset of the group) maybe more receptive to living arrangements which offer the opportunity for greater sociability (i.e., communal or collaborative lifestyles).

4. The mismatch between supply and demand in the private and social housing sectors could be managed to ensure that smaller households live in more space efficient accommodation.

Design, fiscal, educational and advertising approaches to the problem are presented in the following exploratory discussion. These approaches should not be seen as exhaustive merely indicative of possible ways forward. The reaction of developers and one-person households to these solutions was investigated using focus groups, interviews and questionnaire surveys (described in the introduction).

#### 6.1 Design approaches—ecological homes<sup>10</sup>

The first approach considered was accommodating new one-person households in ecological homes. The developers discussed the feasibility of this approach. Currently building regulations (Great Britain, 2002) ensure that new housing development incorporates energy efficiency measures and some renewable energy micro-technologies. The Sustainable Homes Code (DCLG, 2006) and ecohomes rating (BRE, 2006) go further and look at increasing efficiency in terms of several environmental parameters. Neither currently imposes a legal obligation on developers to achieve those standards. In discussion with developers it became apparent that incorporating these environmental parameters into statutory building regulations would be the key driver for ensuring that higher environmental standards were achieved in new residential developments.

Some of the developers interviewed had already constructed demonstration projects in accordance with these higher environmental standards and were considering applying the same principles more widely in their new developments. However, they were concerned that without statutory controls they would be in competition with others who could build more cheaply to lower standards. Although the higher environmental standards attracted some homeowners to live in the demonstration projects, the market for ecological homes was currently limited. Affordability and location were still the key drivers motivating preference amongst potential homeowners.

Developers suggested that by using statutory controls, the problem of competition would be removed and the economic viability of ecological homes would increase. Sourcing suitable materials, technology and expertise for the construction of ecological homes was also identified as a barrier to the development. However, the developers believed that increasing the economic viability of using statutory controls would also encourage professionals to develop skills in this area and create more reliable supply chains for the necessary technology and materials. Thus developers thought that statutory controls would stimulate greater innovation in the industry.

Developers said that in the absence of statutory controls the construction of ecological homes would continue to be ad hoc. Financial incentives could be used to encourage higher environmental standards. Some examples were given including the allocation of cheap sites by local authorities (thereby reducing capital costs—e.g., BEDZED) and prestige sites (where profit margins were more substantial—e.g., Greenwich Millennium Village). Raising design standards was also considered to be

<sup>10</sup> Ecological homes—defined as housing that is designed to be resource efficient in terms of energy, water, land and materials.

more economically viable in larger developments or in instances where other capital costs were covered by government funds (e.g. for land decontamination or infrastructural improvements).

The developers interviewed explained that once ecological homes had been constructed resident behaviour could significantly influence the extent to which resource savings were made. One developer reported that some residents on moving into their new ecological homes removed fixtures designed to achieve greater resource efficiency (including low-flush toilets, triple-glazed windows and low energy light bulbs). In social housing this could be prevented by the terms of the tenancy agreement, however in private developments this level of control is not possible.

The same developer also noted that some residents lacked the awareness needed to operate the technology provided in the most resource efficient manner, even though a homeowner's manual (that explained how to use the technology) was provided. Thus, it is important that residents are made aware of how to use their ecological homes effectively. The developer found one-to-one household training (which demonstrated the most effective use of the accommodation and provided an indication of the monetary savings that could be made) was more effective.

Issues of maintenance were also highlighted. Developers were concerned that it would be difficult to maintain the buildings and technology incorporated into some developments. Their concerns were particularly focussed on maintaining district-heating systems, renewable energy technologies and sourcing of suitable materials for building maintenance. In one instance the developer had remained on site after construction and was acting as the management company, which had proved reasonably successful (although there were some issues with the supply chain). However, most developers did not wish to manage the development after completion, thus specialist management companies with expertise in this area are required in order to maximise the ongoing potential of ecological homes.

Therefore in order ensure that new homes are built to and operate at higher environmental standards the following are needed:

- Additional statutory controls to ensure that higher environmental design standards are achieved in new build.
- Tenancy agreements for residents that ensured ecological fixtures are replaced with similar fixtures.
- Ongoing tuition for residents in how to use the technology most effectively.
- Specialist management companies with the expertise and supply contacts required to maintain and operate the technology and buildings.

The developers believed that there would be a potential market for ecological homes amongst one-person households in the future. This was based on two facts. Firstly one-person households were already living in ecological homes. Secondly most of the growth in new households was expected to be accommodated in new build, which could be built to higher environmental standards. Interestingly market research to determine what motivated the households to live in ecological homes suggested that the environmental benefits were a secondary consideration to other factors including: location, attractiveness of design, affordability and potential resale value (Simpson, 2003). This underlines the need for improved statutory environmental design standards for housing, as the market is unlikely to drive the development of ecological homes at this time.

## 6.2 Design approaches—communal and collaborative housing

The second approach considered was to encourage potential and existing one-person households to live communally in peer-shared households or collaboratively in co-housing. Peer-shared households share communal facilities (usually living space, kitchen and bathrooms) with others living in the same unit. They may also participate in activities communally (household chores, eating, etc). This enables resources and living expenses to be shared within the household leading to greater efficiency.

Cohousing combines the autonomy of private dwellings with the advantages of community living. It has private units, semi-private space, indoor and outdoor communal space. Private units are space efficient but still provide functional spaces for all daily activities (including: kitchen, living area, bathroom, sleeping space). The communal facilities vary but may include dining/kitchen, entertainment, meeting, storage, work and exercise spaces. Cohousers also participate in community activities including meals (several times per week), management maintenance, social events, etc. The design and processes operating in cohousing encourage a “collaborative” lifestyle and greater interdependence between residents. Again this increases space, energy and goods savings.

Substantial resource savings (in terms of land, direct energy and household goods) have been demonstrated amongst those living communally in peer-shared households (Williams, 2003 unpublished and 2005b and those living collaboratively in cohousing (Metzler, 2000 unpublished PhD Thesis; Williams, 2003 unpublished and 2005b). This is largely because space and goods are shared within a household (communally) or within a community (collaboratively). This is further reinforced by the peer pressure and learning networks generated by high levels of social capital, which has resulted in pro-environmental behaviour particularly in terms of energy efficiency and waste recycling (Herring, 2001; Metzler, 2000 unpublished PhD Thesis; Williams, 2005a). The average quantity of energy, space and household goods consumed (i.e., kitchen, entertainment and office equipment) per capita amongst those living in communal peer-shared households and one-person households living in cohousing when compared to averages for one-person households is demonstrated in Table 4.

The presumption is that “regretful loners” seeking opportunities to socialise and live with others could be attracted to collaborative and communal lifestyles. This would in turn increase resource efficiency. This presumption was tested through interviews with “regretful loners”. Responses suggested that both lifestyle options were potentially attractive to the group. However, collaborative lifestyles seemed to be more popular, especially amongst those who viewed living alone as a more permanent lifestyle. Thus, younger regretful loners 18–30 and low-income households viewed living in peer-shared households as being a feasible and attractive alternative to living alone, whilst older age groups (those aged over 30) and more affluent households did not.

Those aged over 30’s dismissal of more communal lifestyles appeared to originate from their perceived lack of control over their own domestic space and problems with re-sale. For the affluent households the communal lifestyle did not provide adequate social cache or economic security. Amongst the 18–30 year olds and low-income groups the attraction of living in peer-shared households appeared to be largely related to opportunities to socialise and affordability. However, these groups did not perceive the lifestyle option as being permanent because of the inherent

**Table 4** Estimated resource savings in communal and collaborative housing

	House/Flat-share average % savings per capita	Cohousing average % savings per capita
Space savings	23	31
Electricity savings	44	57
Kitchen goods savings	30	7.5
Entertainment goods savings	29	0
Office goods savings	38	0

Source: Williams (2005b)

difficulties of buying and selling a unit as a group. They viewed it as the temporary living arrangement until they could afford to invest in a property.

The focus group raised problems with communal living including lack of privacy, noise, access to bathrooms and security of communal storage spaces. All of these problems could be overcome using design for example increased provision of bathrooms; buffer zones between communal and private space; better sound proofing between rooms and secure communal storage space. Those considering communal lifestyles also raised a further issue of recruiting housemates and buying a property as a group. Those considering collaborative housing also highlighted the latter.

Improved mechanisms for finding suitable people to share accommodation and the introduction of a new form of tenure for communal or collaborative living were suggested by the focus group. Increasingly sophisticated methods of finding potential housemates have evolved in the UK, particularly in larger urban areas where property rental and sale prices are higher. Online matching sites, speed housing-dating and agencies to find suitable housemates have all begun to emerge during the last decade in the UK, particularly in London where costs of accommodation are exorbitant. Similar services have emerged in San Francisco for cohousing (Williams, 2005a). Real estate agents have begun to provide services to help potential co-housers find existing communities or create new communities. The growth in these services themselves point to existing market potential for both lifestyles. New forms of tenure have also emerged in the UK—common-hold and co-operative—that will enable a group of individuals to buy and sell property. Potential mortgage lenders are also becoming increasingly open to these arrangements.

Collaborative lifestyles appeared to appeal to most “regretful loners” and was generally perceived to be preferable to living communally, because it offered greater privacy and independence. It also provided the opportunity to socialise and the security of being part of a tightly knit community. A group of one-person households currently living in cohousing were surveyed to determine the types of person attracted to living collaboratively and their reasons for doing so. Cohousing appeared to be particularly popular amongst affluent, well-educated, white, female one-person households aged over 30. However, single never-married men aged 35–44, widows and retired one-person households were also represented.

The majority of the one-person cohousers identified social reasons as being the key benefit of living in cohousing (Table 5). Over half said that opportunities to socialise informally, security, interaction with kids and pets and being able to eat with others, were key benefits of living in cohousing (Williams, 2005b). Increase in

**Table 5** Benefits of living in cohousing according to one-person households

Social	Independent Living	Financial	Sharing Resources	Time Savings
Socializing with others	Well developed support networks	A more affordable lifestyle	Sharing goods	Cooking less
Eating with others	Secure and safe living environment	Financial support from the community	Sharing expertise	Splitting maintenance, cleaning, cooking chores
Interaction with kids and pets			Sharing space	
Living with people with similar interests				
Impromptu social events				

Source: Williams (2005b)

access to a pool of expertise, the financial support provided by the community and the ability to share costs were also attractive. Cohousing was seen as providing a more affordable lifestyle for one-person households because residents could share resources and expense. Residents' ability to share goods (especially those used less often e.g., gardening and DIY tools, washing machines, tumble driers, bikes etc) was also thought to create a more financially supportive environment.

Sharing chores and meals were seen as another great benefit of cohousing for one-person households. They often felt that their leisure time was restricted because of the chores they had to complete in the home, especially those who were working. However in cohousing household chores (cooking, cleaning, gardening, maintenance) are shared within the community, which allows more time for leisure activities. In addition eating communally was seen as having other benefits for example providing the opportunity to socialise with others at meal times, eating more healthily and having dinners prepared for those who were working late on occasions.

A more detailed analysis of the benefits identified by single never-married men aged 35–44, the over 60's and widows was also completed (Williams, 2005b). Opportunities to share maintenance, cleaning, cooking duties, meals and expertise as well as the organisation of impromptu social events appeared to be particularly appealing to single never-married men aged 35–44 (Table 6). This is largely because they work and have busy lives, which means sharing chores within the community creates more leisure time and less stress for them. Also "instant community" is very appealing for those who spend the majority of their time at work and would find it difficult to build social relationships within their community without organised social events including communal meals. The group also appear to be attracted to a community which is financially supportive and in which resources are shared. For those over 60 and widows opportunities to socialise in a safe and secure environment are of key importance. Also the support networks that form within the communities allow older one-person households to live independently for longer.

Thus, there appears to be market potential for cohousing amongst one-person households, "regretful loners" and the growth groups. There also appears to be a

**Table 6** Factors attracting target groups to the cohousing model

	Single never-married men aged 35–44	Widows	Over 60's
Involvement in community never-married	✓	✓	✓
Socializing with others	✓	✓	✓
Support	✓	✓	✓
Ideological (communitarian and environmental)	✓	×	✓
Security	×	✓	✓
Eating with others	✓	×	×
Cooking less	✓	×	×
Splitting maintenance, cleaning, cooking	✓	×	×
Expertise pool	✓	×	×
Impromptu social events	✓	×	×
A more affordable lifestyle	✓	×	×
Interaction with kids and pets	✓	×	×
Living with people with similar interests	✓	×	×
Sharing goods	✓	×	×
Financial support	✓	×	×
Independence with community	×	×	×

Source: Williams (2003 unpublished)

market for communal housing as a more temporary form of accommodation amongst younger age groups (18–30 years old). Successful communal and collaborative housing designs have already been developed in Europe and USA. Governments in Sweden, Denmark and Netherlands have been very politically and financially supportive of these designs, because in social and environmental terms they have been found to be more sustainable than traditional housing forms. In the Netherlands collective housing design principles have even been adopted by mainstream housing projects (Meltzer, 2001; Williams, 2005c).

The developers focus group were asked to discuss the viability of communal and collaborative housing forms in the UK. The group said that accommodation designed for peer-shared households was already becoming available in the buy-to-let market. This accommodation had en-suite bathrooms and improved sound-proofing. Thus the industry had already begun to adapt to this market. Cohousing in contrast was seen to be embryonic in the UK as a result of a number of institutional and market constraints (discussed in detail in Williams, 2005a).

Developers saw cohousing as a largely grass-root phenomenon, but were keen to be involved in projects that were already underway. However, cohousing was seen to be restricted to a small niche market. Developers thought demonstration projects and funds for research could be provided by Government to encourage the development of cohousing communities. This would provide developers with the opportunity to innovate and help to generate markets for the new housing form. It would also enable developers to strengthen their expertise and experience in building and financing cohousing.

Thus ecological homes, communal and collaborative housing designs are all feasible. Demand for communal housing in the buy-to-let and rental markets have been established and developers are already reacting to this in the design of housing. To an extent developers are also already beginning to incorporate environmental design into new housing developments. However, statutory controls could remove

problems of competition and uncertainty for developers and ensure higher environmental design standards in all new housing.

Collaborative housing could be viable if demand increased. Currently it provides an alternative lifestyle choice amongst a very select group. Greater awareness of the benefits of collaborative lifestyles amongst the wider population could increase market interest in the future particularly amongst “regretful loners”. All of these design options may have appeal for one-person households and could mean greater resource efficiency in the future (particularly in terms of land and energy consumption). The key is to provide a diversity of options which are available to the group to ensure that as many as possible are able to live in a more resource efficient manner alone in ecological homes, communally in peer-shared households or collaboratively in cohousing.

### 6.3 Fiscal approaches

The cost of living alone is already prohibitive largely due to increasing accommodation and energy costs. Increasing energy prices are likely to improve efficiencies amongst all households in the future. However, in England and Wales under-occupancy (and thus inefficient use of space) tends to be a problem particularly in the private sector where 57% of properties owned outright are under occupied and 37% with a mortgage are under-occupied. Giving households the option to relocate to smaller accommodation could reduce both land and energy consumption per capita.

An occupancy tax could be charged based on the number of people and habitable rooms in a property to encourage households to live in more space efficient accommodation. In the private sector where residents have greater mobility the occupancy tax might only provide a stimulus for more immediate action. In the social sector households are less mobile because of a lack of the cost of relocating and difficulties in finding suitable alternative accommodation (OPDM, 2000). The cost of relocation and problems of finding suitable accommodation alternatives have also been encountered in the private sector amongst lower-income groups (often older women who have lost a spouse and are still currently living in their family home). Thus subsidies to help these households to relocate and or find alternative accommodation alongside the introduction of occupancy tax is likely to make it more successful.

A relocation package already exists to tackle under-occupancy in the social housing sector in England and Wales but not for private sector housing where the major problem exists. Subsidies are paid by the local authority to encourage residents living in social housing to downsize. The relocation packages identify residents’ needs and help them to find suitable accommodation; pay removal expenses; help to organise moving; and provide money to pay for improvements in residents’ old and new properties. The combination of financial assistance and personal service has proved successful in encouraging households in the social sector to move into smaller accommodation. Similar relocation schemes funded by Government to encourage lower income households in the private sector to move into smaller properties could be introduced.

The introduction of an occupancy tax and relocation fund was discussed with one-person households. The occupancy tax was viewed fairly negatively, whilst the

relocation fund was seen to be an enabler. For more affluent one-person households (particularly single never-married men aged 35–44) the occupancy tax and relocation package would not encourage them to live in less spacious accommodation. For this group design, social status and property value were extremely important and spaciousness was seen to be key to all three. However, older one-person households (particularly those aged over 60 and widows) were keen on the relocation package, particularly the practical help offered in finding suitable property and organising the move.

Low and middle-income one-person households thought that occupancy tax would be an effective deterrent to living in space inefficient dwellings, as long as the tax was set high enough and there was adequate accommodation for smaller households in the social and private sectors. Some of the surplus smaller accommodation in the social sector has been released into the private sector through “right-to-buy”<sup>11</sup> and shared ownership<sup>12</sup> schemes. In addition developers are now building space efficient accommodation for smaller households. Thus, space efficient accommodation for one-person households is now becoming more available. The rate at which to set occupancy tax in order for it to be effective requires a great deal more research.<sup>13</sup>

The developers were keen to build more space efficient accommodation at higher densities, particularly in urban areas where there was a market for this type of accommodation, as this would increase their profit margins. It was felt that occupancy tax and relocation packages would help to increase the market for more space efficient dwellings and thus developers were supportive of the introduction of both. They were also keen that a standard for minimum unit size was introduced into building regulations to remove any opposition from planning authorities for more space efficient dwellings. Thus, it seems that the introduction of an occupancy tax in combination with a relocation package and minimum unit

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<sup>11</sup> The right to buy policy allowed tenants of council homes to buy their property at a significant discount. These properties are now being sold on in the private sector. Thus stock that was formally council owned is now becoming available in the private market.

<sup>12</sup> Shared Ownership is a scheme operated by a Housing Association where the borrower owns part of a property, and pays the mortgage on this, while a Housing Association owns the rest of the property, and the borrower pays rent on this. There is currently a move by Government to enable housing to eventually be owned outright by the tenant. Again this could enable owners to sell on former social housing to private investors.

<sup>13</sup> The resource savings made by households living in house/flat shares in the UK were calculated using secondary data from the Family Expenditure 1991 Survey (Office of National Statistics, 1992) and Energy Supplement of the English Housing Conditions Survey 1991 (DETR, 1997). The data was statistically analysed to determine average annual electricity consumption per capita, quantity of floor space per capita in a unit and ownership of household goods per capita (kitchen, entertainment and office appliances including: cooker, fridge freezer, microwave, dishwasher, washing machine, tumble drier, visual entertainment centre, stereo, fax, PC, telephone). DETR (1997) provided information about floor space (square metres) and annual electricity consumption (kilowatt hours) per capita. ONS (1992) was used to obtain information about household good ownership (i.e., percentage of those households in the sample who owned the goods specified). Consumption data for those living in house/flat shares was then compared with that for one-person households. The average percentage savings were calculated using this data— reported on in Williams, 2003 (unpublished).

size standard, could result in a more efficient use of existing stock and of land for new build.<sup>14</sup>

#### 6.4 Educational approaches and targeted advertising

In the long-term there will need to be a profound cultural shift towards greener consumption patterns (i.e., a reduction in consumption of resources and consumption of more environmentally friendly products). Education and advertising campaigns provide instruments, through which these long-term changes might be achieved. One very successful approach combines education and monitoring to achieve behavioural change. This is an approach adopted by Global Action Plan's Ecoteams. The aim is to encourage pro-environmental household behaviour using education to raise awareness of environmental issues, provide instruction on techniques to reduce consumption and monitor the improvements. The Ecoteams schemes have proven to be very successful.<sup>15</sup>

The annual average resource savings made by communities in the USA who took part in the Ecoteams scheme were considerable. It was found that 35–51% less rubbish was sent to the waste stream; 25–34% less water was used; 9–17% less energy was used and 16–20% less fuel was used for transportation (GAP, 2002). The financial savings made were also impressive (between \$227 and \$389 /household/year -GAP, 2002). In the Ecoteams programme for the Netherlands, the largest reduction was seen in waste production (32% decrease). There was also a 17% reduction in natural gas, 8% reduction in electricity and 7% reduction in water consumption. More importantly these changes appeared to be long term (Table 7). The Ecoteams scheme demonstrates that overall significant, long-term reductions in domestic resource consumption could be achieved through a combination of education and monitoring.<sup>16</sup>

Experiences from the Ecoteams programme (GAP, 2002) and cohousing (Metzler, 2001; Williams, 2003 unpublished) suggest that these approaches are successful for a number of reasons. Firstly residents can learn from each other about the most effective ways of reducing their resource consumption and waste production. Secondly, the improvements accrued (usually measured in terms of units consumed and cost savings) can be seen more clearly at a local level. Thirdly, environmental schemes (e.g., community recycling programmes, district heating systems, etc) and opportunities for sharing resources (e.g., pooling expertise and goods, car pooling, etc) can be achieved more effectively at the level of community (rather than within individual households). Finally, the peer group can reinforce pro-environmental behaviour if schemes are operated at the local level.<sup>17</sup>

It is also important that residents are able to utilise environmental design and technology to its full advantage. The ecological homes research (presented in

<sup>14</sup> Primary data was collected using audits of one-person cohousers living in existing communities to determine the quantity of electricity, land and goods consumed annually per capita. This was compared with the average for one-person households living in self-contained units to determine the resource savings that could be made—reported on in Williams, 2003 (unpublished).

<sup>15</sup> Kitchen goods include: cooker, fridge freezer, microwave, dishwasher, washing machine, tumble drier.

<sup>16</sup> Entertainment goods include: Visual entertainment centre (TV, DVD, VCR) and music centre.

<sup>17</sup> Office goods: PC, fax, telephone

**Table 7** Reduction in resource consumption monitored amongst GAP ecoteams in Netherlands

	Consumption prior to ETP	Consumption shortly after participation	Consumption 2 years after participation	N
Waste (KG/person/day)	.216 (.15)	.153 (.12) = -29%	.145 (.12) = -32%	37
Natural Gas cubic metres person/week)	.299 (.21)	.237 (.18) = -21%	.248 (.18) = -17%	77
Electricity (KWH/person/week)	27.2 (15.4)	25.9(15.6) = -5% ns	25.1(14.3) = -8%	83
Water (cubic metres/person/week	.854 (.38)	.830(.38) = -3% ns	.796 (.33) = -7%	75

Source: GAP (2002)

Section 5.1) suggests that one-to-one practical tuition of residents may be more successful in encouraging behavioural change, than operational manuals and information packs. Certainly workshops to instruct new residents in how to use and maintain the technology provided and maximise the benefits of their accommodation design were suggested by the developer of one demonstration project. A metering system for monitoring resource use in the living units would help to further reinforce appropriate use of the technologies and unit design, especially if financial savings were seen to be made. Again this is a similar approach to Ecoteams where a combination of education and monitoring are used to change behaviour.

An advertising campaign could also encourage pro-environmental behaviour. There has been some success in using campaigns to increase energy efficiency. Energy providers are also now beginning to advertise “greener” energy packages that enable the customer to purchase renewable energy. However, there are no similar campaigns to create markets for resource efficient accommodation even though there are very innovative designs available. Campaigns that target housing preferences are needed in order to develop markets for more resource efficient housing options including ecological homes, cohousing, peer-shared housing. In addition, advertising associated products and services would help to change consumer preference. For example advertising speed dating for house-sharers, triple glazing for ecological homes, relocation packages for downsizers and training schemes for ecological homeowners. It may also be useful to identify potential markets at which to target these advertising campaigns. For example high-tech ecological homes for affluent one-person households, relocation packages for widows living alone in large dwellings and housemate recruitment sites for “regretful loners”.

Overall one-person households felt that both the educational programmes and advertising campaigns described would have a positive effect on their pro-environmental behaviour. They suggested educational programmes and new housing options should be marketed to all households. However, they reinforced the need for targeted advertising for some products and services that would be particularly beneficial to one-person households. Developers supported both the educational programmes and targeted marketing of new housing forms. They were keen on the introduction of the ecoteam approach into new ecological housing developments. It seemed that developers would be prepared to undertake educational and monitoring programmes for residents initially, but they were concerned that this would need to be an ongoing process. Developers suggested that the management company that took over control of the development on completion or residents associations would need to be instrumental in the delivery of the ongoing programmes. Developers also

reacted positively to targeted marketing, to create demand for more innovative housing forms, as well as linked products and services.<sup>18</sup>

## 7 Conclusions

The research suggests that domestic consumption of land, energy and goods (and production of associated waste) is likely to increase in England and Wales as a consequence of growth in one-person households over the next 20 years. This results from an expansion in household numbers, inefficiencies of living alone and increasing affluence amongst the group. To an extent rising energy and accommodation costs could slow the formation of one-person households, which should reduce their environmental impact. Increasing affluence amongst the group may also enable them to consume more environmentally friendly products. Cultural, institutional, economic and technological changes over the next 20 years will of course affect the formation and resource consumption patterns of one-person households in the future. Therefore the environmental impact of one-person households is likely to alter over the next 20 years and requires ongoing investigation.

### 7.1 Opportunities

Maximising current and future opportunities to tackle this problem is crucial. There is a substantial house-building programme planned for England and Wales over the next 20 years. This provides an excellent opportunity to develop and test more innovative forms of housing. One-person households between 2003 and 2026 are expected to account for 72% of annual household growth (ODPM, 2006). Thus they will make up a substantial part of the market for the new housing developed over this period. This provides an excellent opportunity to encourage one-person households to live in a more resource efficient manner in innovative housing forms (i.e., ecological homes and collective housing forms).

The construction of ecological homes should be encouraged through the introduction of more stringent, statutory eco-standards for housing (perhaps based on the sustainable homes code or ecohomes rating system) and demand reinforced with targeted advertising. Collective housing forms are already emerging in England and Wales in an ad hoc manner, but are largely communal (usually peer-shared households) rather than collaborative (e.g., cohousing). The design of these units is beginning to better reflect the needs of residents living communally and incorporates additional bathrooms, communal space and sound proofing into the design.

However, this paper suggests that demand might increase if better associated services were provided, particularly those that assist in household formation (e.g., house-mate speed dating). Cohousing could also be encouraged through the introduction of demonstration projects and targeted advertising. The emergence of “regretful loners” or “forced singles” amongst one-person households also creates potential demand amongst the group for more communal or collaborative lifestyles and thus collective housing forms.

<sup>18</sup> ✓ Means that the group identified the factor as being one of the benefits of living in a cohousing community, whilst × means that the group did not identify the factor

Under-occupancy, particularly in the private sector could be addressed using fiscal and design approaches. The introduction of an occupancy tax in combination with a relocation package could be used to encourage potential down-sizers to move into more space efficient accommodation, whilst minimum unit size standards could encourage the development of space efficient new stock. In existing stock more efficient use of space, energy and pro-environmental behaviour could be encouraged using a combination of fiscal (occupancy tax and relocation package), educational approaches (e.g., ecoteams) and advertising.

Growth in more affluent one-person households could increase resources consumed by the group. However, increase in affluence could equally mean an increase in consumption of green products. It is very important that affluent one-person households are provided with the opportunities to make pro-environmental choices. This essentially means that green products need to be attractive to the group. So for example ecological homes will need to command the social status and resale value of more exclusive accommodation. Cohousing also appears to have potential amongst more affluent one-person households because of the additional facilities provided, social benefits, security, convenience and high resale value. Demand for both should be driven using targeted advertising.<sup>19</sup>

Overall, the key is not to isolate one-person households as a problem group, but to identify the possible opportunities which arise as a result of the group's expansion and diversity. The most effective way of maximising on this potential is to provide a variety of resource efficient options for the group including down-sizing, collective lifestyles, ecological homes, involvement in ecoteams, etc. These opportunities (new housing forms, funding, taxation and educational programmes) must be well advertised to ensure maximum take-up.

## 7.2 Further research

The growth in one-person households is not restricted to England and Wales; it is trend emerging in many developed nations. Thus the environmental impact of growth in one-person households internationally could be substantial. Further research is needed to determine the environmental impact of one-person households internationally, how consumption patterns amongst one-person households vary between nations and the opportunities available in different locations to encourage pro-environmental behaviour amongst the group. In short, an analysis similar to that described in this paper is needed for all nations where there is predicted growth in one-person households to make a fair assessment of the scale of the problem and the diversity of solutions available. Also an investigation into the overall impact of demographic change on the consumption of land, energy and goods is essential, as increase in consumption amongst one-person households may be outweighed by the overall decline in population in developed countries.

For England and Wales a greater understanding of how increasing affluence amongst the group is likely to impact on consumer behaviour and preferences is needed. A more detailed assessment of drivers and barriers to the possible solutions listed is required. Finally, the permanency of the trend for growth in one-person households should be assessed. The future increasing costs of living alone and

<sup>19</sup> ns = non significant

change in cultural attitudes for example may slow the formation of one-person households and reduce their environmental impact considerably.

This paper adds to the theoretical debate on resource consumption through the empirical analysis of data. Not only does it ascertain the impact of one-person households (especially the growth groups) on resource consumption but also possible future solutions to the problem. This builds on the growing literature that focuses on the environmental impact of changing demography and lifestyles.

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