Social capital and energy efficiency in urban householders

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ABSTRACT

This paper examines social capital in urban householders to further understand social influences in relation to energy use. Social capital, or the social resources available through social networks, and related norms of trust and reciprocity, is a recently popularised term. In UK urban environments, social capital is argued to be declining amongst certain populations. This paper takes a preliminary look at the possible connections with social capital and energy use by examining data derived from the English House Condition Survey 1996. This paper argues that insights of potential relationships between social capital and urban householders can increase understanding of energy consumption. It is hoped that preliminary findings here could indicate the need for further research, which could ultimately assist energy efficiency policymakers, practitioners and researchers understand the broader social framework that underpins individual householders' energy use.

Key words: social capital; household energy consumption

1 INTRODUCTION

Household buildings in the UK use approximately 30% of energy generated - with one-third lost to inefficiency (POST 2005) - and contribute approximately 27% (close to 40 million tonnes of carbon) of the countries carbon dioxide emissions (DTI 2006; Defra 2002). Government initiatives such as the Energy Efficiency Commitment and Building Regulations aim to improve technological efficiency to address this wastage and meet the government's energy aims and targets, i.e. reducing greenhouse gas emissions, maintaining a secure energy supply, keeping people warm and maintaining competitiveness (DTI 2003). With moderate successes, implementation is neither universal nor easy, and energy consumption continues to rise. In urban environments, though, energy efficiency of buildings is generally a bit higher, as houses are more likely to share walls, decreasing surface area for heat loss, and be smaller in size.

Beyond building fabric and technology, there is now growing recognition that the social aspects of energy – how people understand, use and interact with energy-using technologies and their homes – are critical in understanding how to reduce energy use. Energy efficient technology - and even public willingness - might exist, but household action to reduce energy use is still not meeting aspirations (POST 2005). Higher energy prices may seem an easy way to both increase awareness and decrease use, however Wilhite, et al (2000) indicate that energy consumers are less concerned about cost-minimisation than about comfort and convenience. Shove (2004) states that socio-technical innovations associated with cleanliness and comfort are based on changeable notions of 'normality'. The social processes of 'normality', or creating and maintaining norms, involves social contact and influence. It is argued here that social capital – social networks and the associated levels of trust and reciprocity – could be an appropriate and useful concept in considering diverse influences that underlie social interactions between people and their surroundings. Why social capital? As Portes (1998) summarises:

> "The novelty and heuristic power of social capital come from two sources. First, the concept focuses attention on the positive consequences of sociability while putting aside its less attractive features. Second, it places those positive consequences in the framework of a broader discussion of capital and calls attention to how such nonmonetary forms can be important sources of power and influence …" (p.2).

Social capital here can offer a new viewpoint to assess the social situation of how to address sustainability, and specifically energy consumption. If information campaigns, technology creation, marketing, and increased energy prices are only marginally working to decrease energy use, perhaps social capital can offer insights into the social underpinnings influencing our energy consumption.

2 SOCIAL CAPITAL, ENERGY, AND URBAN ENVIRONMENTS

2.1 Social capital

Though it is a relatively new term, social capital has become quite popular amongst academics and policymakers. In the UK, a Cabinet Office unit has addressed the national policy options for social capital (PIU 2002). The UK Office of National Statistics implemented a research programme to establish and agree a set of harmonised measurements of social capital (Harper 2001). Internationally, the Organisation for Economic Co-operation and Development has recognised the impact that social capital can have on societal well-being (Cote and Healy 2001) and the World Bank (2004) also supports the social capital concept as a means to alleviating poverty and working for sustainable social and economic development.

Social capital broadly refers to the social resources available through networks, social norms and associated levels of trust and reciprocity. It was popularised in the 1980s and 1990s through the influence of a number of social scientists, notably Pierre Bourdieu, James Coleman and Robert Putnam, though the broader concept has existed in social science discourse for quite some time (Portes 1998).

Bourdieu (1986) defined social capital as “the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalised relationships of mutual acquaintance and recognition” (p.248). An individual accrues benefits by being involved in, and constructing, the social world, and can draw upon those benefits and resources (Portes 1998). Bourdieu also emphasises the presence and fungibility (exchangeability) of social capital with other types of capital, namely cultural and economic capital.

Coleman (1990) defines social capital as "a variety of different entities having two characteristics in common: They all consist of some aspect of a social structure, and they facilitate certain actions of individuals who are within the structure" (p.302). He claims social capital is productive, like other forms of capital, and partially fungible. Similar to Bourdieu, Coleman's (1990) definition focuses on social embeddedness: "social capital inheres in the structure of relations between persons and among persons. It is lodged neither in individuals nor in physical implements of production" (p.302), but is a resource to the actors.

Putnam (2000) states that "social capital refers to connections among individuals – social networks and the norms of reciprocity and trustworthiness that arise from them" (p.19). Putnam goes on to distinguish between what he identifies as bonding and bridging capital. Bonding social capital is exclusive, existing in close relationships (e.g. between family members). Bridging capital extends to larger social networks, including acquaintances, is inclusive and useful for information diffusion.

Policymakers seek to enhance social capital in an effort to increase social

cohesion. Most often, social capital is seen as a 'good' thing; higher levels of social capital are associated with better health and well-being and good economic performance (Hall 1999; Halpern 2005), lower levels are associated with higher crime rates (Lochner, Kawachi et al. 1999).

More commonly, social capital will most likely trigger ideas of other types of capital, notably economic (monetary wealth) and human capital, a term popularised in the 1960s by policymakers referring to individual skills and knowledge (Coleman 1990; Schuller 2001). Further, cultural capital consists of social prestige (expressed in taste and 'distinction'), gained through knowledge, education and skills. Cultural capital is closely related to social capital, as it can either be acquired through social networks (Portes 1998; Monkman, Ronald et al. 2005) or considered a form of social capital (Gould 2001). The term physical capital covers the physical inanimate instruments, tools and objects in life. Similarly, natural capital refers to naturally occurring environmental resources (Pearce and Barbier 2000). Are these forms of capital? Robison, Schmid et al (2002) argue that, at least in terms of social capital, the use of 'capital' is justified because it has "many important capital-like properties including transformation capacity, durability, flexibility, substitutability, opportunities for decay (maintenance), reliability, ability to create other capital forms, and investment (disinvestment) opportunities" (p.1).

The concept of social capital has its critics. Fine (2001) criticises it as a "chaotic, ambiguous, and general category that can be used as a notional umbrella for almost any purpose" (p.155). Critics and proponents alike highlight the lack of clarity and agreement in the definition of social capital and lack of standardisation in operationalisation. But social scientists who employ the concept argue that social capital is a useful tool to explore and tackle social problems.

Social capital has traditionally been measured by assessing levels of organisational membership and levels of public trust. When examining trends in the UK, Hall (1999) found associational memberships were at similar levels in the 1990s as to the 1950s, but show a widening in disparity between social classes, revealing a slight increase in social capital in middle classes compared with manual and service classes. Warde et al (2003) show a stabilisation of associational levels in the late 1990s. Hall (1999) found that levels of social trust have fallen, and indicates that differences exist between generations, with younger people holding less social trust. Halpern (2005) similarly assesses social capital in the UK as having declined unevenly across social classes, though now possibly plateauing. Grenier and Wright (2006) believe that the decline and social class disparity is actually much more drastic.

2.2 Urban social capital

Urbanisation is often characterised by high population density, transient living, high mobility, and crime. Urban areas have been implicated in affecting social capital, though it is not always a straightforward connection of 'the more

urban, the less/more social capital'. For example, as Halpern (2005) points out, crime is conventionally associated with cities. However, he illustrates that crime does not affect cities homogenously, but is focused in neighbourhoods. In the UK, he finds there is more crime in 'striving' neighbourhoods (poorer areas) and 'rising' neighbourhoods (well-off professionals, but with low social capital). People do not feel safe if crime is high, and have lower levels of public trust – a component of social capital. However, this can be broken down even further by considering different 'rising' areas. For example, Butler and Robson (2001) investigate gentrification of three different London areas and finds uneven levels of social capital, despite similar processes of change (i.e. increase in middle class inhabitants). Regarding 'striving' neighbourhoods, the World Bank (2001) draws on the different types of social capital (i.e. bonding and bridging) in addressing issues of 'poor communities', arguing that it is essential to use existing forms of bridging social capital to scale up local community efforts (in Field 2003, p.133).

Halpern (2005) also states that residential mobility, and particularly those moving into cities, disrupts and weakens social networks, quoting several studies that have found negative correlations between mobility and neighbourhood-level social capital (p.262). He does argue that improving telecommunications may be helping migrants, in particular, maintain bonding social capital with distant people. However, the effect of this may be that local bonding social capital is not built.

Putnam (2000) argues that it is suburbanisation, rather than urbanisation, that decreases social capital in the United States. He advocates reduction in travel time, increase in pedestrian-friendly areas (see also Leyden 2003) and public spaces (urban design) which allow for socialisation. Halpern (2005) concurs on the issue of urban design, stating is has an important effect on how much and in what capacity people socialise in public spaces. He quotes studies that find that instead of forcing interaction, "positive social relationships rest on the ability to regulate your social interactions with others" (p. 265), rather than being forced to do so, particularly regarding places with a high population density (i.e. cities). Changing physical spaces can affect socialisation, trust and social capital. Conversely, Butler and Robson (2001) indicate that social capital can affect the physical environment: "social and cultural capital combine … in the successful communal pursuit of improvements to the environmental and institutional infrastructure of the locality" (p.2159). In theory, high social capital and collective action can inspire local improvements and ownership and, by extension, broader environmental sustainability of urban areas.

2.3 Social capital and sustainability

Even though energy consumption is an indirect form of consumption (mediated through energy-using technology) and 'invisible' (Shove and Warde 1998), it is useful to explore the literature of social capital and sustainability, particularly in regards to consumption. Briceno and Stagl (2006) assert that social capital is critical in inspiring sustainable consumption. They argue that social capital can deliver satisfaction, which is what people are seeking when

they act as consumers. "In addition, more trust and communication between economic actors induces more cooperation between different levels of consumption systems, reduces inefficient competition for resources, and increases the provision of locally appropriate and collectively owned goods" (p.1544). The authors argue that programmes to encourage sustainable consumption must be implemented via social systems, "to remove the structural barriers to change, enhance the rate of adoption through socialisation processes, and increase the benefits derived from the assets of social capital itself" (p.1544). Similarly, Lai (2001) argues that social capital must be considered to comprehensively discuss consumption. For example, trustworthy information, identified by Lai (2001) as a form of social capital, means that people trust others in their social networks more than advertisers or salespeople when it comes to deciding on products or services to purchase, making consumption more efficient. It is important to note that this does not imply 'sustainable' consumption, only the facilitation of consumer purchasing. However, Warde and Tampubolon (2002) concluded from a study of leisure consumption and social capital and friendship that "social capital [is] less than adequate as a conceptual tool for the analysis of consumption" when interpreted "as either a Bourdieusian or a Putnamesque account might suggest" (p.177). They favour using social networks in considering consumption. As social networks are a primary element of social capital, their criticism would appear to focus more on measures of social capital and the lack of accounting for complexities in assessing quality of relationships.

In a study focusing on adaptive capacity, risk and climate change, Adger (2003) claims that bonding social capital and networking (or bridging) social capital are important in collective response. Though he admits the two different types of social capital are difficult to differentially measure, he asserts that networking social capital is important at the local level “for understanding social differentiation in vulnerability” (p.396) and bonding social capital (between families) is useful to cope with extreme events. Further, he states that governments are essential in understanding and utilising social capital in order to enhance abilities for local and national adaptive response to climate change.

3 RESEARCH DESIGN

In order to test the hypothesis that social capital and urban energy consumption are related, a preliminary investigation is made here using UK survey data. The UK Office of National Statistics (ONS) created a survey matrix, and out of this a Social Capital Question Bank, which harmonises the scope of social capital and questions for its operationalisation (Harper 2001; Office of National Statistics website). Methodologies vary across the identified governmental and non-governmental surveys that have been identified. But the topics of the social capital-related questions are all grouped in five themes:

- Participation, social engagement, commitment;
- Control, self-efficacy;
- Perception of community level structures or characteristics;

- Social interaction, social networks, social support; and
- Trust, reciprocity, social cohesion.

These five themes relate closely back to the definition(s) of social capital above. They are also similar to the World Bank's "Measuring Social Capital: An Integrated Questionnaire" (Grootaert, Narayan et al. 2004) dimensions identified: groups and networks; trust and solidarity; collective action and cooperation; information and communication; social cohesion and inclusion; empowerment and political action.

The ONS originally included twenty-one surveys that had elements of questions in the above five themes. For the purpose of examining a relationship with energy consumption, data from one of those - the English House Condition Survey (EHCS) 1996 - was examined here. The EHCS 1996 was commissioned by an UK government department, conducted by MORI and NOP, and consisted of four surveys: an 'interview' survey (conducted between January and May 1996), a 'physical' survey (began mid-April) run in parallel with the 'postal' survey (of landlords) and a 'valuation' survey. The interview survey yielded valid information for 16,100 addresses; the other three surveys were sub-samples (DCLG website). It was a cross-sectional analysis that used stratified random sampling. The ECHS:

> "aims to provide information on the changing condition and composition of the housing stock and the characteristics of the households living in different types of housing in England" (Harper 2001, p.32).

This survey, however, was not included amongst the 15 identified in the derived Social Capital Question Bank, probably because questions only indirectly addressed three of the possible forty-seven sub-themes. It is important to stress that this places an important caveat on the strength of the relationship found between measures of social capital and domestic energy use. The operationalisation of social capital is limited by instrument and research design, and a lack of questions in this survey to cover social capital means one variable will be used as a proxy for quite a complex and wide-ranging concept.

As a very preliminary examination, the EHCS 1996 data results were used here in standard SPSS models as it contained measurements of:

- *Energy* (labelled tannkwh) – this information was derived from a combination of the interview survey and supplemented by separate survey information from British Gas and electricity board records, with permission from respondents. The units of this interval variable are total annual kilowatt hours.
- *Nature of the area* (labelled area96x) – this information was derived from interview and other surveys and corrected for inconsistencies, containing no missing data. The categories of this ordinal variable are 'city centre,' 'urban', 'suburban residential', 'rural residential', 'village centre', 'rural'.
- *Satisfaction with neighbourhood* (labelled q275) – this was the most

straightforward of the ONS identified social capital questions. The categories of this ordinal variable are ‘very satisfied’, ‘fairly satisfied,’ ‘neither satisfied nor dissatisfied’, ‘fairly dissatisfied’, ‘very dissatisfied’ and ‘no opinion’.

Standard statistical tests were run in SPSS, according to the type of variable (Academic Technology Services website), as follows:

- *Energy* and *Nature of area*: an analysis of variance (ANOVA) test was performed, as *nature of area* is a categorical independent variable and *energy* is a normally distributed (after natural log was applied) interval dependent variable, to test for a relationship between the two
- *Energy* and *Satisfaction with neighbourhood*: again, an ANOVA test was performed, as *satisfaction with neighbourhood* is a categorical independent variable and the log of *energy* is a normally distributed interval dependent variable, again, to test for a relationship between the two
- *Nature of area* and *Satisfaction with neighbourhood*: a cross-tabulation was performed between these two categorical variables to test if there is a relationship between them.

In addition, all three variables, *energy*, *nature of area*, and *satisfaction with neighbourhood* were run through a factorial ANOVA test, which is designed to test the relationship between categorical independent variables (and the interaction between the two) and a single, normally distributed interval dependent variable.

As the EHCS conducted a stratified sampling (over-sampling certain populations), an appropriate grossing factor (weighting) had to be applied to data to obtain representative results of the UK population (EHCS 1996 User Guide).

The hypothesis tested is that "satisfaction with neighbourhood", type of neighbourhood (i.e. urban, suburban, rural, etc.) and amount of energy used in a household show a relationship.

4 RESULTS

Of the tests ran in SPSS, the ANOVA test *energy* with *nature of area* showed that the relationship was significant (p<.001), as in Table 1.

Table 1: ANOVA (energy and nature of area)

Log_tannkwh

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	423355.018	5	84671.004	81252.994	.000
Within Groups	20175500.231	193610 53	1.042		

Total	20598855.249	19361058			

Therefore, the mean of *energy* differs significantly by categories in *nature of area.* To find out if there was a significant difference in means between all groups, a standard post hoc pair-wise comparison between means was conducted using a Tukey HSD test for the ANOVA. There was a significant differences (p<.000) of means between all combinations of types of area.

An ANOVA test for *energy* and *satisfaction with neighbourhood* showed that the relationship was significant (p<.001), as in Table 2.

Table 2: ANOVA (energy and satisfaction with neighbourhood)

Log_tannkwh

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	118987.195	5	23797.439	22524.885	.000
Within Groups	20392828.369	19302334	1.056		
Total	20511815.564	19302339			

This also indicates that the mean of *energy* differs significantly by level of *satisfaction with neighbourhood*. A Tukey HSD test was performed here, as well, and found significant differences (p<.000) in mean total kilowatt hours between all levels of satisfaction *except* between 'no opinion' and 'very dissatisfied' (p=.478).

A cross-tabulation and chi-square was performed on the two categorical variables (Table 3): *satisfaction with neighbourhood* and *nature of the area*. The Pearson's chi-square test was significant (p<.000).

Table 3: Chi-Square test (satisfaction with neighbourhood and nature of area)

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	911815.314(a)	25	.000
Likelihood Ratio	954820.943	25	.000
Linear-by-Linear Association	604894.978	1	.000
N of Valid Cases	19555885		

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 966.59.

In addition, a factorial ANOVA was run on all three variables (Table 4). The dependent variable was 'total annual kilowatt hours', with fixed factor of 'nature of area' and covariate 'satisfaction with neighbourhood'. The Tests of Between-Subjects Effects (total annual kWh by nature of area; total annual kWh by satisfaction with neighbourhood; and nature of area by satisfaction

with neighbourhood) were all significant (p<.000). However, the R square was very low (.028), meaning that only 2.8% of the variance would be accounted for.

Table 4: Tests of Between-Subjects Effects

Dependent Variable: Log_Tannkwh

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	570834.881(a)	11	51894.080	50232.061	.000
Intercept	95495603.155	1	95495603.155	92437151.614	.000
area96x	225593.500	5	45118.700	43673.677	.000
q275	606.281	1	606.281	586.864	.000
area96x * q275	37169.240	5	7433.848	7195.763	.000
Error	19940980.682	19302328	1.033		
Total	1872968470.094	19302340			
Corrected Total	20511815.564	19302339			

a R Squared = .028 (Adjusted R Squared = .028)

A 'parameter estimate' test was run in conjunction with the factorial ANOVA (Table 5).

Table 5: Parameter Estimates

Dependent Variable: Log_Tannkwh

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	8.944	.003	3336.614	.000	8.939	8.950
[area96x=1.00]	.251	.005	54.151	.000	.242	.260
[area96x=2.00]	1.088	.003	376.508	.000	1.082	1.093
[area96x=3.00]	1.015	.003	369.164	.000	1.010	1.021
[area96x=4.00]	1.105	.003	370.469	.000	1.099	1.110
[area96x=5.00]	.449	.004	105.089	.000	.441	.458
[area96x=6.00]	0(a)	.	.	.	.	.
q275	.096	.002	58.283	.000	.093	.099
[area96x=1.00] * q275	-.012	.002	-5.635	.000	-.017	-.008
[area96x=2.00] * q275	-.194	.002	-113.977	.000	-.197	-.191
[area96x=3.00] * q275	-.163	.002	-97.434	.000	-.167	-.160

[area96x=4.00] * q275	-.236	.002	-128.867	.000	-.240	-.232
[area96x=5.00] * q275	-.051	.003	-18.036	.000	-.056	-.045
[area96x=6.00] * q275	0(a)	.	.	.	.	.

a This parameter is set to zero because it is redundant.

These results allowed a fitted line graph to be constructed, using the standard line formula (1):

$$Y = mx + b \quad (1)$$

where y equals the log of the total annual kilowatt hours (log tannkwh); m equals the B value for satisfaction with neighbourhood (q275) multiplied by the number corresponding to the satisfaction level (1, 2, 3, …6); x equals the adjustment for that area (i.e. [area96x=1.00]*q275) multiplied by the number corresponding to the satisfaction level (1, 2, 3, …6); and b equals the intercept (8.944) added to the adjustment for each area (i.e. [area96x=1.00]).

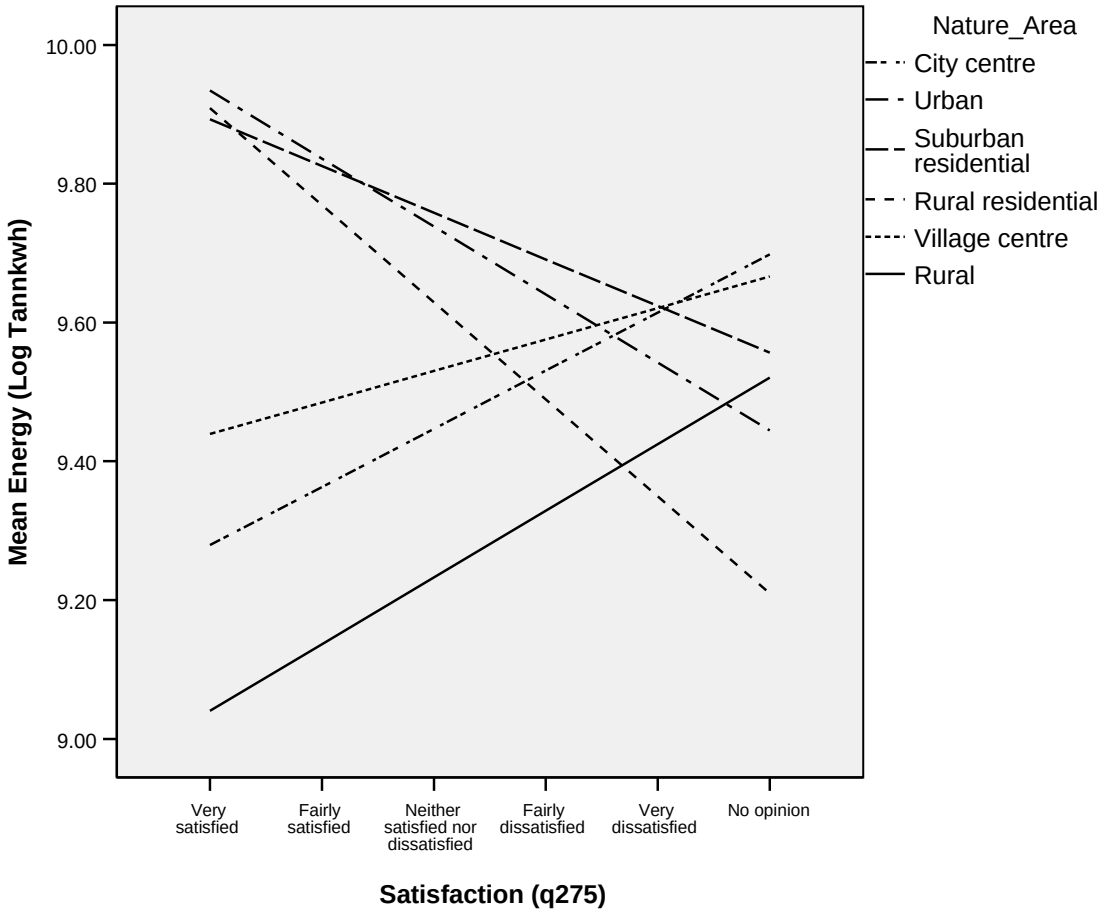
The result in graphical form (Figure 1) suggests that as satisfaction with neighbourhood decreases, the average (mean) *energy use in the following areas* ***increases***:

- city centres
- village centres
- rural

And as satisfaction with neighbourhood decreases, the average (mean) *energy use in the following areas* ***decreases***:

- urban areas
- suburban residential areas
- rural residential areas.

Figure 1 - Energy Use and Satisfaction with Neighbourhood by Nature of Area



Generally, it was found that from the EHCS 1996 data which was manipulated to test for social capital, energy use and urban/rural differences, there is reason to believe that these three variables are related from the factorial ANOVA test. However, it must again be noted that the results of the factorial ANOVA yielded a low R square, which means that the results will only account for a very small amount of variance (2.8%). The findings here indicate that further investigations would be needed to test this hypothesised relationship.

5 DISCUSSION

Social capital – the social resources that exist in social networks, norms and trust and reciprocity – has, in past studies, been positively associated with better health, well-being and lower crime rates. It is also linked with adaptive capacity in responding to risk, such as climate change, with societal adaptive capacity and social cohesion. In urban environments, levels of social capital can vary markedly by neighbourhood, even between areas that may seem to be similar in their social make-up. Levels of social capital may fluctuate more quickly in urban areas, particularly where there are higher levels of mobility (both physically and socially).

On the household level, our investigation was concerned with identifying whether or not there is reason to believe there is a connection of social capital to sustainability, and specifically sustainable energy consumption. From the factorial ANOVA of three variables – energy consumption, nature of the area, and satisfaction with neighbourhood – we constructed a fitted line graph to indicate that energy use slightly increases in city centres, village centres and urban areas as satisfaction with the neighbourhood decreases. Conversely, energy use slightly decreases in urban, suburban residential and rural residential areas when satisfaction with neighbourhood decreases. The reasons for these disparities by area are not immediately obvious. Forrest and Kearns (2001) point out that neighbourhood social cohesion and community spirit are usually higher in "mature and wealthy home-owning areas" (p.2131). Therefore, income, social status, length of residence, and owning a home may be implicated in the energy-satisfaction-urban link. The authors further indicate that the elderly and unemployed and poor tend to rely on local ties. The relationship between area and type of social capital (i.e. bonding versus bridging) may also be important. However, in the following quote, it is obvious that much more work is needed to assess the significance and characteristics of neighbourhood social cohesion:

> "[Ellen and Turner (1997)] … point out that from the US evidence at least: 'No consensus emerges about which neighbourhood characteristics affect which outcomes, or about what types of families may be most vulnerable to problems in the neighbourhood environment. On these questions, the existing empirical evidence is inconsistent, incomplete, and sometimes contradictory', " (in Forrest and Kearns 2001, p.2136).

Regarding energy use, considered in the broader sense of 'consumption', Forrest and Kearns (2001) point out that, "what we consume and who we consume it with are increasingly important parts of the social cement of contemporary urban life and this is reflected in the increasingly sophisticated classification of neighbourhoods in terms of consumption patterns and lifestyle groups" (p.2142). Careful examination of *neighbourhood* effects and associated types of social capital may be necessary to more fully understand household energy consumption.

The findings from this paper may be indicative, but they are not conclusive. There may be a number of reasons for this. First, social capital is a complex concept and the single variable of 'neighbourhood satisfaction' may not be adequate to fully capture any true representation of social capital. Second, it has never been proved that social capital has a direct affect on energy consumption. It may be more likely that social capital is responsible for enabling information flows, allowing access to knowledge and information about energy, energy-using devices, building fabric, etc. Further research is needed to know if social capital should be directly tested against energy consumption, and which combination of variables (socio-demographics, lifestyle-related, and social capital themes) would more fully reflect a relationship with energy consumption. Third, the research design (a cross-

sectional stratified random sample survey) may not have been appropriate, particularly for testing social capital. As Halpern (2005) notes, the effort of measuring social capital challenges conventional methods. He indicates the research design should be based on clustered sampling to "estimate ecological-level, or neighbourhood, effects" (p.287). Further, "direct behavioural measures, such as 'lost envelope studies' and blood donation, may prove more reliable estimates than conventional survey designs, which tend to be biased towards socially desirable answers and respondents who may be atypical of the general population" (*ibid*). As well, he points out that non-response itself could be a key indicator of social capital. Therefore, research design and choice of method should be sensitive to the concept of social capital. Combining this type of investigation with energy use would be novel, and probably require spatially-differentiated (by time and or location / neighbourhood) information. Research must be sensitive to class, in particular, as blanket statements on social capital are probably not accurate due to the nature of social divisions that exist in the United Kingdom. Finally, there is no accounting for different types of social capital, such as 'bonding' or 'bridging', which Putnam (2000), Adger (2003) and the World Bank (2001) suggest have different associations, and may affect different groups and populations with varying outcomes. Different types of communities may be more responsive to initiatives focused on bonding or bridging capital, whether 'striving', 'rising', or otherwise.

It may be that energy efficiency programmes are best disseminated, understood and actually adopted long-term through simultaneously utilising and promoting social capital during the campaign. Field (2003) indicates that social capital will influence implementation of policies:

> "More ambitious programmes to promote social capital are bound to be attractive to governments who are seeking not just to provide services to people, but to engage them in changing behaviour and values in respect of such policy fields as public health, environmental protection and lifelong learning" (p.135).

He warns, though, that governments need to avoid undermining existing social capital when trying to invest in it, and be careful that outcomes are socially positive. He further states that since social capital research is still in an early stage, "it is simply not possible … to predict with any confidence whether more ambitious measures will achieve their goals" (*ibid*). In the case of energy efficiency, it would be necessary to ensure a programme was addressing 'sustainable consumption' so that increasing social capital would not actually cause further increases (on top of current trends) in energy use.

6 CONCLUSION

Social capital has been found to be useful in academia and policymaking as a method to understand social networks, trust and reciprocity in order to determine and increase social cohesion and non-monetary forms of power. The study of social capital in an urban environment has particular value in trying to assess changes and inequalities. Energy consumption will generally

be lower in urban areas, due to less surface area to lose heat through and smaller homes. But the link between energy consumption and social capital, particularly in urban environments, has not been made clear. In this preliminary investigation, statistical tests were performed on three variables from the EHCS 1996 survey data: satisfaction with neighbourhood (an element of social capital, as indicated by the ONS), energy, and the nature of an area (i.e. city centres, rural areas, etc.). A factorial ANOVA was performed and the relationship was statistically significant, but counted for little variance. When this data was fitted into a line graph, it was found that people in city centres, village centres and rural areas used more energy as they became more dissatisfied with the neighbourhood. Urban areas, suburban residential areas and rural residential areas used less energy as they because more dissatisfied with the neighbourhood. The results are slightly indicative, but not conclusive, and there is little evidence to indicate why these differences might exist. Further research is needed to assess the strength (or existence) of a relationship, and whether it is a direct one. Social capital is not a straightforward concept, and debates still exist about its definition, operationalisation and measurement. The complexity of energy use – an 'invisible' form of consumption – and social capital and the interaction between the two would have to be carefully considered. It is likely that, more than finding a direct correlation, social capital simply enables the flow of trusted information about energy consumption. Findings could be extremely useful for local authorities and energy efficiency campaigners. If high, or higher, levels of social capital are necessary for sustainability, as some authors purport, then energy use – a major contributor to global climate change – would be best addressed whilst also considering both the benefits of existing social capital and ways to increase it.

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