Looking at Lifestyle: The Impacts of American Ways of Life on Energy/Resource Demands and Pollution Patterns

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ABSTRACT

We report findings from work in progress on lifestyle and household consumption. The larger research draws upon a variety of data sources to examine differences among California residential consumers in terms of their electricity and gas usage, building and appliance characteristics, travel behavior, water use, waste water and solid waste generation, recycling, and household-generated emissions. The goal is a new multi-resource household-level model of consumption and pollution. The findings presented here focus directly on household electricity and natural gas usage. We first consider the literature on variability in household consumption and particularly differences between lifestyle groups. Then we examine empirical patterns of electricity and natural gas usage across the lifecycle and within associated income and ethnic groups. The prospects for adding other forms of household consumption to the model are considered. Finally, implications for policy and forecasting are introduced—particularly issues related to environment/efficiency program designs, policy instruments, equity impacts, and social marketing.

The Problem with Averages

We often hear in environmental discourse that "the average American consumes ten times as much as a person in __(*country X*)__. " It is certainly true that the United States consumes, on a per capita basis, vastly more energy and resources than many other societies in the world. However, this does not mean that all Americans are equally consumptive, nor that there actually is an "average American" to be sought out either for congratulations (for their good fortune) or castigation (for their greed).

In energy analysis, differences in consumption across the residential or household sector tend to be glossed over, since it is hard to understand just what to do with that information. Data showing a good deal of variation in electricity and natural gas use among residential consumers are usually averaged across the entire population, or within select subpopulations—e.g., within a utility territory, climate zone, or housing type. In detailed policy models, such as the California demand forecasting model, housing units and appliance populations (rather than households) are the molar units for analysis and prediction.[1] In these models, estimates of current aggregate energy usage for particular types of equipment (e.g., refrigerators, clothes driers, air conditioners) are "built up" additively to the population level, using the relative "saturations" of various appliances in the population, and their average "unit energy consumption" (UEC) rates. Assumed changes in population, equipment saturations and efficiency are projected to future years in forecasting.

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[1] The California Energy Commission model and the U.S. Department of Energy's National Energy Modeling System are probably the best-developed "bottom-up" models of residential energy demand in use in the U.S.

Human agency in the choice of equipment and housing, social processes of allocation of these goods, and behavioral choices and actions in energy usage (e.g., selecting temperature settings, usage patterns of appliances and systems), are not explicitly considered, and are, in fact, buried in the averages. This is hardly surprising, since it is not clear how these could be easily incorporated into the model without (1) securing valid and reliable data on these processes and choices, and (2) adding new modules that would introduce new uncertainties in the estimation of equipment saturations and UECs. The effects on model performance and estimation with new information has not been tested, and alternative specifications that more centrally incorporate social patterns of consumption have not been offered for comparison. One of the goals of the larger research, for which the work reported in this paper is a preliminary step, is to experimentally construct alternative models and examine their value in energy forecasting and policy modeling. At this stage, we are focusing on California because of the availability of quality data and policy interest in modeling and segmentation in that state.

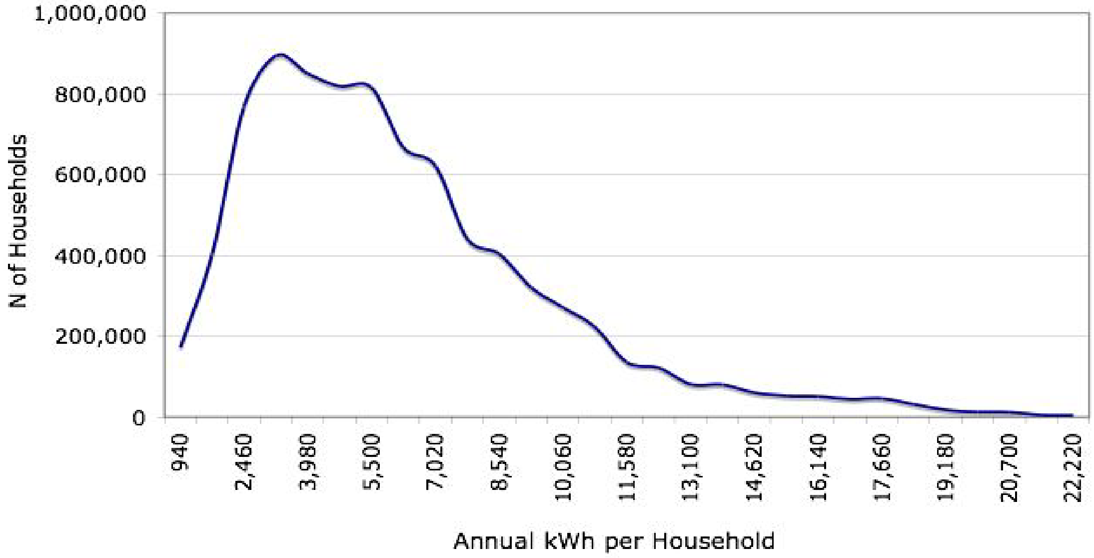
Social Variations in Energy Use

The variability of energy usage patterns across the residential population is striking, and not readily (or accurately) captured in household averages. That variability is certainly influenced by environmental conditions—particularly temperature changes through time and across different geographies (or "climate zones" in forecasting and planning language). Variability is also influenced by building size, building shell characteristics, and HVAC systems and appliances in use (and their efficiencies). All of these factors are considered (although often not measured with any precision) in conventional energy analysis. However, variability in consumption is also strongly influenced by occupants' patterns of use of space, their management of shell and systems, and usage patterns of appliances and other energy-using equipment. Also, decisions to adopt new behaviors (either conserving or non-conserving) and to purchase new equipment (either more efficient, or just more stuff), contribute to variability in consumption as well.

But despite the fact that we can identify multiple factors affecting energy consumption levels in households, some of which are included in conventional modeling practice, the strikingly broad distribution of consumption levels has to be seen to be appreciated. Figure 1 shows the distribution of electricity consumption (kWh/year) among California households, and Figure 2 shows the distribution of natural gas consumption (therms/year) for the same group. It should be noted that these figures do not show electricity consumption for municipal utilities. Sacramento and several smaller public utilities were not included in the study (they conducted their own), and we have excluded Los Angeles data because of sample bias that distorts statewide estimates (for details, see CEC 2004, 53). The figures fit curves to histograms in which the distribution is segmented into 100 bins for electricity and 50 bins for natural gas.

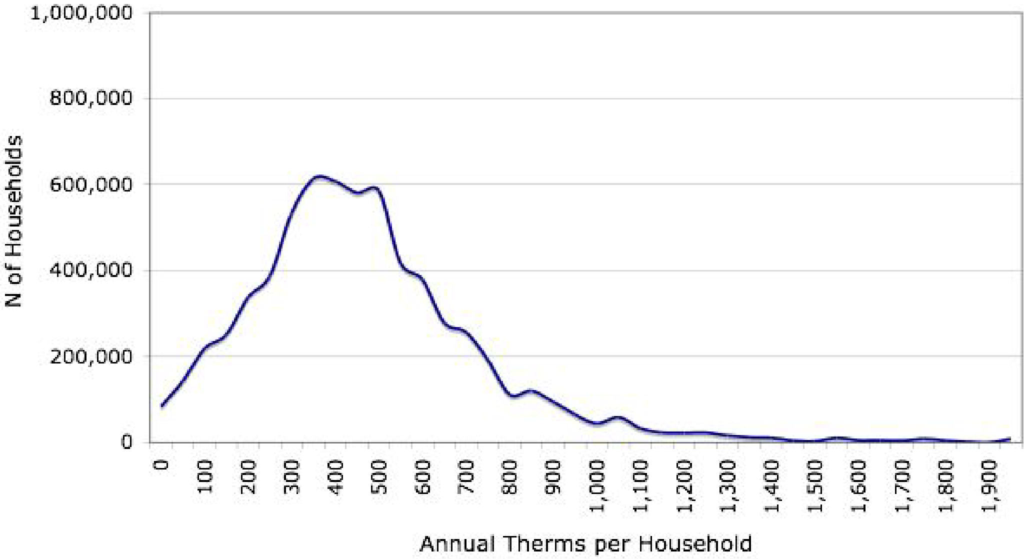
The overall annual mean for electricity consumption is about 6,050 kWh. As you can see from inspecting the figure, this value is pulled upward by high energy users in a highly skewed distribution. It represents the consumption of no "typical" or "average" "energy user." The lowest quartile (25%) of households uses an average of about 2,350 kWh/year, which represents about 10% of all residential consumption in the state and is less than ¼ of the average consumption of the highest quartile (at nearly 11,500 kWh/yr). The top 25% of users together consume nearly *one half* (47%) of all residential electricity used in the state. The middle two quartiles (50% of the population) consume the remaining 43% of total electricity. If there were a *typical* user, s/he would be found somewhere in that group—although consumption there also ranges widely, from 3200-7500 kWh/year.

Figure 1. Distribution of California Residential Electricity Consumption



Source: RASS (CEC 2004).[2]

Figure 2. Distribution of California Residential Natural Gas Consumption



Source: RASS (CEC 2004).

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[2] For confidentiality reasons, the authors did not have access to these data. However, as contractors to the California Energy Commission for work presented in this paper, they were able to request data reports from CEC staff.

The story for natural gas is similar. Mean consumption for the California residential population is about 460 therms/year.[3] The average consumption of the lowest quartile of households is only ¼ of that of the top quartile, who in turn account for about 40% of total natural gas used by residences in the state. The middle 50% of the population use almost exactly ½ of the total natural gas sold in the residential sector in California.

It is one thing to say, "well, this all has to do with differences in houses, appliances, and preferences…" and, if pressed, "…some houses are bigger and some people have bigger families and some seem to prefer higher rates of energy use." But these are not very satisfying explanations. They tell us little about the highest users ("how do they do that?") or the lowest users ("are they suffering?" "what's it like to live that way?"). They also tell us little or nothing about the differences in the middle (which are still quite large for both electricity and gas)—where those differences come from, what they mean, how elastic or inflexible they might be. There are real needs—for policy development, equity, efficiency program design, and forecasting—to better understand the variability in household energy demand, and particularly to determine how it may be usefully segmented in the population (and how this may change in the future).

Disaggregating and Segmenting

There has been a fair amount of theoretical and empirical work done on differences in energy use across households. We will not review it here in any detail.[4] The earliest studies focused on the effects of income and race on energy demand (e.g., Newman and Day 1975), and provided a basis for the low-income energy assistance programs that have been in place in the U.S. since the 1970s. Other early work by Uusitalo (1983) in Finland and Socolow and his colleagues in the U.S. (Socolow 1978; Sonderegger 1978) pointed to socio-demographic differences in consumption and significant behavioral differences even within economically similar groups. For example, Sonderegger (1978) found that roughly 54% of the variance in energy use could be explained by obvious physical features of dwellings and equipment, while the remaining 46% of the variance was the result of "behavior patterns of the occupants" (Sonderegger 1978:228).

Subsequent work by Hackett, Lutzenhiser, Wilhite, Wilk, Erickson, Shove, and others found not only significant socio-economic and behavioral differences among households associated with differences in their energy use, but they also advanced theoretical explanations for the differences.[5] For example, they focused on the role of collective (i.e., social) processes and choices, including everyday routine habits and practices (such as comfort, cleanliness, and convenience) that are negotiated by household members within a larger social context of the expectations regarding what makes a "good home."

In these accounts, people are seen to be caught up in complexes of behavior that also involves their buildings, their equipment, one another, their work, and their lifestyles. They have certain kinds of patterns of occupancy and travel and energy flows that result. They also hold beliefs about how they should live, and the practices and habits that they expect from others (e.g., how many parties you should throw, how many people live in your house, etc.). One

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[3] A therm equals 100,000 Btu.

[4] For a review, see Lutzenhiser (1993).

[5] See Erickson (1997); Hackett & Lutzenhiser (1991); Shove et al. (1998); Wilhite and Wilk (1987).

important aspect of these social routines, norms and expectations involves status display (e.g., what you have, what you have to have, and how big it has to be). Because everyone can't (and doesn't want to) practice conspicuous consumption at the same levels, the resulting patterns of behavior, technology use and consumption are highly variable across the population. And, there are certainly other social and cultural dynamics that differentiate consumption as well.

The Notion of Lifestyle

A number of energy researchers have used lifestyle and cultural distinctions as a way to better understand and explain variations in energy use (see, for example, Erickson 1997; Gossard 2004; Lutzenhiser 1997; Lutzenhiser & Gossard 2000; Schipper et al. 1989; Uusitalo 1983). What is meant by "lifestyle?" Unfortunately, this is both a powerful notion and a concept that has yet to receive a widely agreed-upon definition.

In sociology, the term has often been used to refer to ways of life, choices and preferences, behaviors and attitudes, associated with various "social locations" or positions in societies and communities. Lifestyle has been defined by energy analysts as "patterns of human activities" (Schipper et al. 1989:275), "persistent behavior patterns of occupants" (Sonderegger 1978:227), and "values, behaviors, practices, and possessions that are characteristic of a family" (Gladhart et al.1986:17). Gossard and Lutzenhiser have done the most thorough review of the relevant social science and applied policy literatures in this area.[6] They propose a general definition of lifestyle intended to provide a starting point for further research in this area: "[lifestyle consists of] distinctive modes of existence that are accomplished by persons and groups through socially sanctioned and culturally intelligible patterns of action" (Lutzenhiser and Gossard 2000:215).

Along these lines, empirical studies over the past two decades have shown that lifestyle dimensions related to income, education, family size, number of people living in the home, number of hours that a home is occupied, size and type of dwelling, and stage of lifecycle (e.g., young singles, young families, families with teenagers, empty-nesters, and retired households) are important indicators of household energy consumption. However, research has also shown that households with similar characteristics (household composition, technological configurations and housing sizes) can also significantly vary in their energy consumption. So there are volitional, habitual, cultural, attitude/value dimensions at play here as well.[7]

Recognizing the segmented character of consumption and conservation potentials, the Electric Power Research Institute (EPRI) developed a psychographic segmentation scheme in the 1980s that featured both elements of social stratification (high to low class or income) and value-orientations/personality (EPRI 1990). Little came of that effort, most likely because of difficulties in collecting data needed to segment utility customers, and some fundamental problems with the 'values and lifestyles' approach taken (which had sketchy theoretical foundations and an opaque methodology).

But at the end of the day, it is clear that a variety and a combination of lifestyle factors—including socio-demographic, material culture and psychological/attitude/value factors—are all implicated in the relationship between "ways of life," on one hand, and energy use, on the other. Because the most readily available data concern socio-demographics, we are using them in the

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[6] See Gossard (2004); Lutzenhiser & Gossard (2000).

[7] See Lutzenhiser (2003) and Shove et al (1998) for reviews. Also contact authors for references to relevant work.

work reported here (hopefully in cautiously appropriate ways). However, we fully recognize that measurement of important dimensions of personal choice/values is absent in our analysis, and that these undoubtedly are responsible for important variations in the observed relationships between technology, behavior and energy use. At this stage, we hope only to exhaust the possibilities of the available socio-demographic data.

Toward an Empirical Typology of Lifestyle and Consumption

An important goal of our project, for which the current paper offers a preview, is to determine the feasibility of constructing an empirically based categorization of lifestyles along a variety of consumption dimensions. In order to keep our focus manageably narrow for the first cut in this research, we decided to focus on household energy use in the state of California. We are familiar with the state from earlier studies and, as noted, there are some fairly high quality data available. These include: the U.S. Bureau of the Census, American Community Survey (ACS) 2004, the California Residential Appliance Saturation Survey (RASS) 2003, and data from our work with the California Energy Commission and California utilities related to the 2001 electricity supply crisis and the more recent natural gas price shocks.[8] We are also working with data on household travel behavior and gasoline use, water consumption, solid waste generation and emissions (discussed briefly below).

The ACS was used primarily to identify the most common household forms (e.g., living arrangements composed of single persons, couples, adults with children, extended families, and so on). Nearly *one third* (31%) of California households have only *one adult member* (about 1/5 of those, or 6% of total households, also include one or more children). Nearly *half* of California households (47%) are made up of *two adults* (with about half of those, or 23% of the total) also having one or more children. Among households with children, there is an average of two children (1.96) per household. The remaining 22% of California households have three or more adults (mostly 3), with or without children. From this group, we have included in our typology only households that appear to be multigenerational or "extended" families (about 9% of the population). In total, our typology includes 87% of the population, ignoring (for now) 13% of the population that lives in other large and more heterogeneous groupings.

Age—of both adults and children—also turned out to be an important dimension. Children, quite naturally, *tend* to occur in households with adults who are of younger ages, and the prevalence of children declines in the population as households grow older. Therefore, we have attempted to capture the age dimension, along with household size and composition, in a composite *lifecycle* variable that ranges from single young adults, through older couples (with and without children), to larger multi-generational households. Tables 1 and 2 present the structure of the typology as it has been developed to date. Future work may simplify it further—although we are convinced that it incorporates a range of theoretically significant differences among households that are likely to be associated with differences in housing, appliances,

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[8] See CEC (2003) Lutzenhiser et al. (2003), USBC (2004). There are problems with each of these data sources, including limited access, sample biases, different timeframes, varying contextual conditions (price, population, environment, economy), non-comparable variable sets, and incompatible coding schemes. Good judgment, cautious use of variables and limited generalization are all called for. However, all are large samples and when the work is done with care, similar patterns can be observed across the data sets.

behaviors, investments, and overall consumption—especially when considered in conjunction with ethnicity and income. The literature suggests that both of these latter two factors are clearly associated with lifecycle, as well as with one another, and with energy usage. A major goal of the larger research is to better understand the nature of those inter-relationships—and particularly how they work through physical and technical systems.

Table 1. Basic Age Categories

Symbol	Label	Age Range
c	Child/children	Infant - 18
Y	Young adult	19-34
M	Medium age adult	35-54
O	Older adult	55-64
S	Senior	65-99

Table 2. Lifecycle Typology

Category Symbol	Description of Type (Household Size and Composition)	Est. # in Pop. (Millions)	% of Pop.
Y	Young single adult	.54	4.5
Y+c	Young single w/ child/ren	.23	1.9
M/O	Medium or Older single	1.48	12.4
M/O+c	Medium or Older single w/ child/ren	.48	4.0
S	Senior single	.95	7.9
YY	Young couple	.54	4.6
YY+c	Young couple w/ child/ren	.72	6.0
YM/MM	Young and/or Medium age couple	.88	7.3
YM/MM+c	Young and/or Medium age couple w/ child/ren	2.03	17.0
OO	Older couple	.69	5.7
OO+c	Older couple w/ child/ren	.16	1.3
SS	Senior couple	.63	5.3
YMO	Medium and/or Older adults w/ Young adult	.26	2.2
YMO+c	Medium and/or Older adults w/ Young adult and child/ren	.37	3.1
MOS+c	Three adult, mult-generational household	.44	3.7
Others	*larger and more complex groupings*	*1.57*	*13.2*
Total		*11.95*	*100.0*

Source: Raw data from ACS (USBC 2004) restructured by authors.

The multivariate models being developed to model consumption at the household level are not described here. However, some important differences within and between lifecycle groups can be seen in Table 3, which presents patterns of income distribution, ethnicity, housing, home ownership, and direct energy consumption (electricity and natural gas).

Table 3. Key Characteristics of Lifecycle Groups

Lifecycle Category	Income Low & High (%)		Language Spoken at Home (%)			Dwelling (%)		Energy Usage	
	< $25K	$100K+	Eng.	Span.	Asian & other	Single Family	Own	kWh (RASS)	Therms (RASS)
Y	.39	.05	.72	.13	.16	.27	.18	3,190	236
Y+c	.66	.01	.64	.32	.04	.40	.11	4,442	297
M/O	.33	.10	.80	.09	.11	.53	.49	4,202	311
M/O+c	.39	.07	.69	.21	.10	.66	.41	5,393	411
S	.65	.04	.80	.09	.12	.65	.64	4,657	435
YY	.15	.19	.63	.20	.18	.40	.27	4,767	315
YY+c	.23	.11	.42	.48	.11	.63	.38	5,395	402
YM/MM	.11	.35	.69	.18	.14	.70	.62	5,883	430
MM+c	.13	.31	.51	.31	.19	.82	.68	7,212	519
OO	.12	.35	.75	.12	.13	.88	.83	7,256	499
OO+c	.17	.36	.63	.19	.18	.85	.77	8,694	603
SS	.23	.12	.74	.10	.17	.87	.86	6,388	560
YMO	.07	.43	.54	.21	.26	.88	.80	6,984	512
YMO+c	.10	.28	.38	.45	.17	.85	.69	7,205	545
MOS+c	.06	.27	.20	.56	.25	.83	.68	7,166	517
Overall	*.25*	*.20*	*.62*	*.23*	*.15*	*.68*	*.58*	*6,050*	*460*

Source: Energy use: RASS (CEC 2004); all others: ACS (USBC 2004).

We see that when groups are differentiated on the basis of age (from Y to M, O, S), numbers of adults (Y, YY, MM, OM, etc.) and presence of children (+c), they display highly varied patterns along other key socio-demographic variables. Some groups are markedly more likely to be low-income (Y+c and S), while others have much higher incomes (YM, MM, OO, OO+c, YMO). Some are much more likely to be non-English speakers at home (a more powerful indicator of cultural difference than self-identified “ethnicity;” note that a number of English-speaking households with Hispanic and Asian backgrounds are *not* included in those categories). These include younger couples (YY, YY+c), medium aged couples (MM+c) and extended families (YMO, YMO+c, MOS+c). Single family detached vs. multi-family unit housing are also differentiated by lifecycle, as is home ownership. Finally, the simple social differences in lifecycle stage are expressed in large differences in both electricity and natural gas usage.

We cannot go into further detail here. It is valuable to note, however, that these are all bivariate patterns and that the multivariate relationships among these variables are interesting and important to understand in much greater detail than has been reported in the literature to date. Also, we have examined the relationship of these variables with other, unmeasured, factors that might also explain consumption differences. For example, we looked for associations between lifestyles, income and climate zones. We found little evidence that groups with higher rates of electricity use, for example, live disproportionately in warmer climates. Actually, the older and more affluent groups were slightly more likely to live in temperate coastal climates.

Comparing Lifestyle Differences

By combining information on household lifecycle with information on housing types, income, and ethnicity for particular lifecycle groups, some even larger differences can be observed. For example, in our preliminary analyses, we have examined a matrix of energy use levels for different ethnic groups at different lifecycle stages and with different income and housing profiles. At this point in our research, our working definition of *lifestyle* focuses on combinations of those traits. Table 4 presents some of the results from the exploratory analysis, showing the energy usage levels for some selected—but fairly representative—lifestyle types.

Table 4. Consumption Levels of Illustrative Lifestyle Groups

Lifestyle Group	kWh	kWh ratio	Therms	Therms ratio
YY+c MultFam $25-50K Hispanic	3,254	.54	210	.46
S SnglFam <$25K Anglo	4,685	.78	491	1.07
OO Townhouse $50-75K Anglo	5,327	.88	344	.75
MM+c SnglFam $100-150K Asian	5,920	.98	473	1.03
MM+c SnglFam $100-150K Afr Amer	7,936	1.32	792	1.72
OO SnglFam $150K+ Anglo	9,725	1.61	522	1.14
Population Averages	*6,030*		*460*	

Source: Raw data from RASS (CEC 2004) with lifecycle groups specified by authors.

By introducing the ratio of observed annual kWh and therms for each group to the overall sample means (again, 6,030 kWh and 460 therms), we can see the combined effects of lifecycle stage, housing, income, and cultural preferences/possibilities in this (admittedly imperfect, but considerably improved) specification of lifestyle. We can infer some expected effects of income and dwelling characteristics, but also seem to detect the influences of household composition, possibly culture and almost certainly habits accumulated through time.

Adding Information About Other Forms of Consumption and Waste

The "ecological footprint" measure is a widely accepted metric that allows comparisons of the environmental impacts of consumption in terms of relative resource demands and impacts (spatial "footprints") on the planet (Wackernagel & Rees 1996). This measure was originally developed to compare countries. However, more recently, environmental groups have adapted the footprint approach to assess individual impacts. Unfortunately, footprint analysis necessarily relies upon population averages again, and is relatively insensitive (at this point in time) to disaggregated patterns of consumption and impact.

However, we take seriously the key point of footprint analysis, namely that household impacts reach far beyond the direct use of energy in the home. So our research intends to also bring into the analytic and policy frames information on other (and, we believe, quite likely lifestyle dependent) forms of consumption. We are particularly interested in the consumption of travel (e.g., automobile use) and water, as well as the production of solid wastes (garbage) and other forms of pollution (e.g., atmospheric emissions, and particularly CO2). Our hope is that a volumetric accounting for major household energy and emissions flows might complement the spatial accounting of the footprint approach.

Travel

Preliminary analysis of household transportation data shows that distributional patterns of gasoline consumption are similar to those of electricity and natural gas. For example, with an overall average of 1,056 gallons of gasoline consumed per year to travel an average of 21,028 miles per household, a large number of cases consume in excess of 1,500 gallons per year, while many others actually use less than 500 gallons (DOT/EIA 2001). Just who is traveling where, and for what purposes, remains to be determined. But it will be important to understand the relationship(s) between energy use in the home and on the road, which may take a variety of different forms.

Water

Data collected by the American Water Works Association in 1999 in twelve locales in the U.S. in 1999 (some in California) show high levels of water usage, considerable variability across the population, and significant conservation potentials. Mean annual water use was estimated at over 146,000 gallons per household (AWWARF 2006). Across all study sites, something less than ½ (42%) of water use was for indoor purposes. We strongly suspect that rates of water use are correlated with electricity and natural gas use.

Solid Waste (Garbage)

California studies of household waste loads cannot be disaggregated to the level of the household. But they do estimate the annual per capita disposal rate for the state at .35 tons per person in 2003. The average household in a single family dwellings generated 2,128 lbs of solid waste, including: organics (food, prunings, textiles) 935 lbs., paper 455 lbs., plastics 208 lbs., demolition 225 lbs., metals 138 lbs., glass 59 lbs., and electronics 43 lbs. Discards from multifamily dwellings averaged 1,737 lbs in the same period.

Estimating Carbon Emissions

We plan to make provisional pollution estimates for carbon emissions based on (1) electricity generation emissions, (2) direct combustion of natural gas at the dwelling, and (3) emissions from household vehicles. The carbon content of gasoline is easily estimated (approximately 20 lbs. of CO2/gallon) at 21,000 lbs. (*10 tons*) of CO2 for an average California household—although, again, there is considerable variation around this average. Emissions from natural gas usage on site is similarly easy to estimate (approximately 11 lbs/therm) at 5,060 lbs. (*2.5 tons*) of CO2 for the average California household—with, as we have seen, considerable variation around that average as well.

Estimating carbon dioxide emissions from electricity generation is a little trickier, since it depends upon the source fuels (coal, natural gas, geothermal, hydro, nuclear, etc.) and their efficiency of conversion at the point of production. Because California enjoys a highly diversified portfolio of electricity sources and is not heavily dependent (as are many utilities in the mid-west and northeast) on large amounts of coal-fired generation, a conservative estimate of average household CO2 from electricity consumption (.75 lbs/kWh) is 4,495 lbs. (*2.25 tons*) per year. The average total from all three of these sources can be estimated at 14.75 tons of CO2 per year. In lifestyle terms, a very large proportion of the population will produce *much greater amounts* of CO2 than this average, while an equally large number will produce less—*some much less*.

Issues in Data, Analysis and Applications

As noted, the work underway is more challenging that we had first imagined (which may help to explain the fact that no one else has yet successfully attempted it). Data sources are dispersed, vary in time scale, geographic scope, quality, bias, and commensurability. "Back of the envelope" estimates are possible, and they do help to give a sense of the magnitudes of different forms of consumption (e.g., the carbon impacts of driving vs. operating a gas furnace). However, we are committed to a more rigorous integration of data from different sources at levels/points of aggregation that make sense both theoretically and empirically. This is not a task that is easily or quickly undertaken. The point of this paper has been to review some of our work and findings to date, with an eye toward stimulating the interests and imaginations of other investigators, and to make the point that this work is needed to open policy relevant discussions about consumptiveness, sufficiency, lifestyle, and need (and perhaps greed).

Policy Implications

From a policy point of view, we would certainly like persons to make efficient energy choices, to behave in more conserving ways, and to fashion lifestyles that are less wasteful and destructive. However, we know from more than two decades of research that not everyone is equally able to make changes, and that the impacts of policies do not fall equally across the population. Early on, Dillman et al. (1983) found that, when faced with a conservation imperative, low-income households lowered energy consumption among all end uses, while higher income households maintained energy consumption and/or took advantage of tax credits and incentive programs. Similarly, they found that higher income groups were more able and willing to invest in efficient equipment and housing (also see Lutzenhiser et al. 2003 for a review).

So the first policy realm in which we would like to make a contribution involves *equity*. The choice of policy instruments (e.g., taxes, prices, subsidies, penalties, codes, social marketing) can be much more thoughtful and refined with knowledge of social location, usage patterns and resources—allowing us to move well beyond conventional "technical potential" approaches to consider what we might call "segmented potentials."

A second concern is how policy can take culture into account in understanding patterns of usage and acceptable alternatives. Not only are lifestyle patterns of energy use constrained, they also are deeply rooted in social expectations and cultural understandings. These factors strongly influence the types of material goods that meet the expectations of a particular lifestyle group—e.g., the size or type of house and appliances one should have, the style of car one should drive, and the like (Hackett and Lutzenhiser 1991). At the same time, equipment such as solar panels may be met with disapproval in some quarters, while they may be a symbol of concern for the common good and future generations in others (Gossard 2004). We see a need for both detailed pattern analysis of existing data, as well as the collection of new data focused on culture, values and consumption styles.

The study of lifestyle and energy use has a long history with little actual application in energy policy. There are many factors that account for this. However, the increasing seriousness of energy-related environmental problems, coupled with a renewed interest in energy security, suggest that there may be a more receptive policy audience for lifestyle research. In addition, real-world events seem to have eclipsed common wisdom about energy and American lifestyles. The California energy crisis of 2001 revealed that consumers can be strongly motivated by a combination of cost-consciousness, efficiency-consciousness (avoiding waste), environmental values, and altruistic interest in "doing our part" for the common good. Californians, at least, have been sensitized to energy as an issue, and have shown that they can take action when necessary (Lutzenhiser et al. 2003). If they are now shown—graphically, vividly, convincingly—that existing lifestyles have consequences and that there are acceptable alternatives, they may be willing to consider changes that the energy policy community has yet to imagine.

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