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Reducing Energy Costs in Rental Housing

The Need and the Potential

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This research brief describes the direct and indirect energy cost burdens that renters face, and the disproportionate share of both total housing outlays and household income that lower-income tenants pay for energy. The analysis also looks at differences in energy costs and use between renters and homeowners living in various types of housing, as well as geographic variations in energy costs. The paper then examines the "split-incentive" problem in the landlord-tenant relationship and outlines strategies to overcome this barrier to efficiency and affordability.

Energy accounts for a substantial share of the cost of living in rental housing. According to the American Housing Survey (AHS), the typical renter directly paid 13 percent of gross rent (rent plus tenant-paid utilities) and 4 percent of household income for energy use in 2011. In addition, renters pay indirectly for utility costs that are included in their rent. Tenants living in multifamily rental buildings also pay indirectly for the costs of heating common areas, exterior lighting, and so on. Indeed, the 2012 Rental Housing Finance Survey (RHFS) indicates that multifamily property owners' expenditures for energy—including both buildings where tenants pay for utilities and those where the rent includes utilities—represent about 9 percent of rent receipts.

Low-income tenants bear a particularly large burden for energy costs. Because their costs nearly equal those of higher-income renters, energy accounts for larger shares of their incomes and overall housing costs. In 2011, more than one-fourth of all renter households had incomes below $15,000. These lowest-income renters devoted $91 per month to tenant-paid utilities, while renters with incomes above $75,000 paid $135 **(Figure 1)**. Among renters billed directly for all energy use, the median monthly expense was $116 for lowest-income households and $151 for highest-income households.

For lowest-income renters, tenant-paid household energy costs represent 15 percent of income. And for those lowest-income renters who pay for all utilities, energy costs represent 21 percent of income. The larger share of gross rents and of incomes that lower-income renters devote to energy costs reflects the fact that energy use is a necessity and does not change proportionately when incomes rise or fall. But the larger cost burden on low-income renters also arises from the lower energy efficiency of their housing, requiring more energy for a given level of comfort or service.

ENERGY COSTS FOR RENTERS AND HOMEOWNERS

Owner-occupied housing consumes more energy per unit, but rental housing uses more energy per square foot of living area **(Figure 2).** In 2009, owner-occupied homes consumed a median of 92.5 million BTUs at a cost of $2,069, while rental units used 54.8 million BTUs at a cost of $1,317. Owner-occupied homes are typically double the size of rental units (2,051 versus 924 square feet). As a result, energy consumption per square foot was just 43,700 BTUs

($0.99) in owner-occupied homes, substantially lower than the 53,400 BTUs ($1.29) in rental units. Energy use per square foot is higher for renters than for owners living in most types of structures, as well as overall.

Several factors may contribute to these differences. One is the number of people per household. Although renter households included 2.4 persons and owner households 2.6 persons on average in 2009, the average number within each structure-type category was higher for renters. In single-family detached homes, for example, renter households consisted of 3.2 people on average, while owner households included 2.7. In structures with five or more units, household size averaged 2.0 among renters and 1.6 among owners.

Thus, rental units typically have less space per person than owner units. While more crowded conditions should not drive up heating costs (the biggest component of energy use), the larger number of household members relative to area in renter households may lead to higher consumption of energy per square foot for other uses, such as water heating, lighting, and refrigerators and other appliances.

FIGURE 1

Energy Cost Burdens by Renter Household Income

	Household Income					
	All	Less than $15,000	$15,000–29,999	$30,000–44,999	$45,000–74,999	$75,000–and Over
All Renters						
Households (000s)	36,856	10,124	9,464	5,963	6,570	4,735
Monthly Energy Expense ($)	111	91	108	116	123	135
Monthly Income ($)	2,359	674	1,915	3,096	4,750	8,332
Monthly Gross Rent ($)	842	615	762	884	1,030	1,372
Energy Expense as Share of Income (%)	4.2	15.4	5.7	3.7	2.5	1.4
Energy Expense as Share of Gross Rent (%)	12.9	14.9	14.1	13.2	12.0	9.9
Share of Units Built Pre-1980 (%)	67	71	70	67	64	61
Renters Paying All Utilities						
Households (000s)	27,528	6,894	7,077	4,637	5,231	3,689
Monthly Energy Expense ($)	131	116	128	132	138	151
Monthly Income ($)	2,499	669	1,915	3,124	4,750	8,332
Monthly Gross Rent ($)	874	665	785	896	1,035	1,375
Energy Expense as Share of Income (%)	5.2	20.8	6.9	4.3	2.8	1.7
Energy Expense as Share of Gross Rent (%)	15.3	18.9	17.0	15.0	13.3	11.2
Share of Units Built Pre-1980 (%)	63	66	65	64	59	57

Notes: Values shown for income, expenses, and energy use are medians. Data exclude units with no cash rent.
Source: 2011 American Housing Survey.

ENERGY USE IN OLD AND NEW STRUCTURES

There have been steady improvements in the efficiency of housing over time, so that energy use relative to living area is lower in newer buildings. In 2009, median energy use per square foot was just 41,700 BTUs for rental units built in 2000 or later, compared with 72,100 BTUs for units built before 1940 **(Figure 3).** Newer owner-occupied dwellings are also more energy-efficient than older ones, but the differences in efficiency related to the age of the structure are not as pronounced as in rental housing.

The intensity of energy use is lower in owner-occupied housing than in rental housing of the same vintage. Energy use per square foot is about 10 percent lower in owner-occupied housing than in rentals built since 1980, but among units built before 1940, owner-occupied homes consume 35 percent less energy per square foot. This suggests that there have been more energy-efficiency improvements made to owner-occupied housing than to rental housing since those structures were built.[1] It also underscores the great potential for efficiency improvements to older rental buildings.

GEOGRAPHIC VARIATIONS IN COSTS

Renters' direct energy costs, as well as the shares of gross rent and income they pay for energy, vary across locations **(Figure 4).** As might be expected, cost burdens in states with mild climates, such as California, are relatively modest. The patterns among states with less benign climates, however, are not closely correlated with temperature. Differences in energy prices, in the mix of fuels used, and in the characteristics of the housing stock offset the effects of climate.

1 These improvements would include appliances and equipment. Pivo (2012) found that multifamily rentals had fewer energy-efficiency features, such as Energy Star appliances and programmable thermostats, compared with other types of housing. He also found that rentals occupied by low-income households had fewer energy-efficiency features than those occupied by higher-income renters. Similarly, Davis (2010) found fewer Energy Star appliances in rental housing than in comparable owner-occupied housing.

Renters in the New England states, along with Alaska and Delaware, generally have the highest monthly energy costs. Renters in the upper Midwest states, such as Minnesota, Wisconsin, and the Dakotas, have heating and cooling loads (as measured by heating-degree and cooling-degree days) equal to or greater than those in New England, but median renter energy bills are much lower. Although the biggest factor in this disparity is lower energy prices, Residential Energy Consumption Survey (RECS) data (available at the state level only for the largest states) indicate that the amount of energy used in the upper Midwest is also lower on both a per unit and per square-foot basis. This may reflect the age distribution of the housing stock.

FIGURE 2

Housing Characteristics and Energy Use by Tenure and Structure Type

	Single-Family				Multifamily							
	Detached		Attached		2-4 Units		5 or More Units		Mobile Homes		All	
	Owner	Renter	Owner	Renter	Owner	Renter	Owner	Renter	Owner	Renter	Owner	Renter
Total Units (000s)	63,223	7,720	3,925	2,730	1,459	7,456	2,323	16,635	5,540	1,235	76,471	35,775
Size (Sq. ft.)	2,239	1,536	1,840	1,275	1,331	909	1,044	770	1,044	840	2,051	924
BTUs per Unit (Millions)	99.5	83.6	80.0	67.0	89.8	59.7	45.7	39.5	64.6	61.8	92.5	54.8
BTUs per Sq. Ft. (000s)	42.6	51.9	40.5	53.1	56.5	60.9	43.2	49.4	57.9	65.9	43.7	53.4
Annual Energy Cost ($)	2,159	1,851	1,721	1,514	1,988	1,395	1,206	1,023	1,749	1,665	2,069	1,317
Cost per Sq. Ft. ($)	0.95	1.16	0.90	1.15	1.23	1.42	1.09	1.28	1.61	1.99	0.99	1.29
Persons per Unit	2.7	3.2	2.3	2.8	2.0	2.4	1.6	2.0	2.6	2.9	2.6	2.4
Sq. Ft. per Person	961	560	949	528	779	490	784	481	485	342	916	497
Year Built (%)												
Pre-1970	42	58	30	46	66	57	30	35	6	14	39	45
1970–1989	27	26	40	34	22	31	39	40	50	52	29	35
1990–2009	31	16	30	20	13	13	31	25	43	34	32	21

Notes: Values shown are medians, except number of units, persons per unit, and share built. Data exclude units with no cash rent.
Source: US Energy Information Administration, 2009 Residential Energy Consumption Survey.

Among rental units in New England where tenants pay all utilities, 58 percent were built before 1960, compared with only 33 percent in the West North Central Census Division and 29 percent for the nation.

At the same time, typical energy expenses for renters living in southern states such as Alabama, Georgia, and Mississippi exceed the national median. In combination with their relatively low rents and incomes, households in this region thus devote larger shares of both gross rents and household incomes to energy than elsewhere in the country.

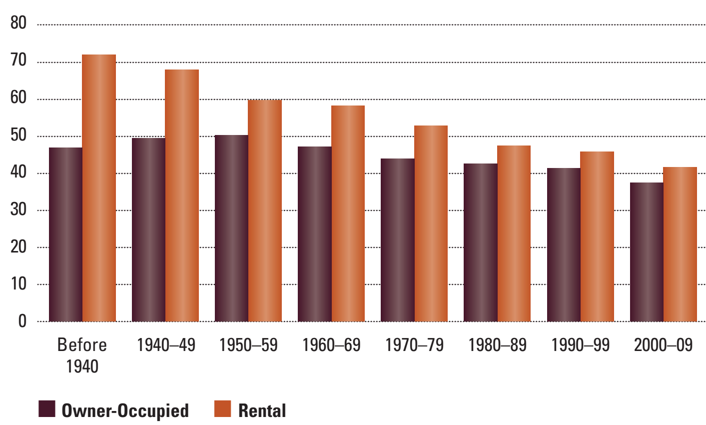
In 2011, residential energy prices in the Midwest and Rocky Mountain states were about 20 percent below the national average of $22.84 per million BTUs, while those in New England and the Southeast were above that average. Some of the difference in the average BTU price arises from consumption of different types of fuel. The national average price per million BTUs in 2011 was $34.34 for electricity and $10.78 for natural gas **(Figure 5)**. In states where electricity accounts for a larger share of total energy use, average residential energy costs per BTU thus tend to be higher.[2] (And to the extent that electricity accounts for a larger share of energy use for renters than for owners, the average price paid by renters is higher than the state residential average shown in Figure 4.)

Differences in the mix of structures used as rental housing also factor into the geographic variation in renters' energy costs. States where rental housing is concentrated in multifamily structures with five or more units tend to have lower median energy costs.

FIGURE 3

Older Rental Housing Offers Substantial Opportunities for Energy Efficiency Improvements

Median Annual Energy Use (Thousands of BTUs per square foot)



Source: US Energy Information Administration, 2009 Residential Energy Consumption Survey.

THE SPLIT-INCENTIVE PROBLEM

Rental property owners make decisions about features that affect energy efficiency, including the quality of appliances, insulation, windows, and doors. Tenants, in contrast, make choices about energy use such as turning lights on or off, setting the thermostat, or deciding what water temperature to use for showering or washing clothes.

Incentives for conservation or for indifference to energy waste depend on who pays the bills. If the property owner covers energy expenses in the rent, at no marginal cost to the tenant, households have an invitation to overconsume energy. In the more typical situation where renters pay for their energy use, the property owner may see less reason to invest in energy efficiency. This conflict of interests between landlords and tenants, frequently referred to as the split-incentive problem, poses perhaps the biggest hurdle to controlling energy costs in rental housing (see, for example, Fisher and Rothkopf 1989; Jaffe and Stavins 1994; Gillingham, Harding, and Rapson 2012; International Energy Agency 2007).

2 Considering only the price per BTU somewhat overstates the adverse cost impact of using electricity for heat, hot water, and other needs because electricity is converted into heat more efficiently than other fuels.

FIGURE 4

Renters' Energy Costs and Cost Factors by State: 2011

		Renters Paying All Energy Costs				Share of Rentals (%)			Price per Million BTUs ($)		Degree Days	
State	Total Rental Units (000s)	Units (000s)	Monthly Energy Costs ($)	Energy Costs as Share of Gross Rent (%)	Energy Costs as Share of Gross Income (%)	Built Pre-1960	With Electric Heat	In Structures with 5 or More Units	All Energy	Electricity	Heating	Cooling
Alabama	495	451	170	25.4	8.2	19	72	34	27.93	32.52	2,620	2,079
Alaska	87	33	190	14.5	4.5	13	22	32	21.50	51.63	na	na
Arizona	809	683	130	15.3	4.8	9	72	41	28.11	32.48	2,167	3,181
Arkansas	338	299	150	22.9	7.1	15	60	30	21.28	26.42	3,356	2,055
California	5,437	4,603	80	7.1	2.6	29	36	47	22.35	43.30	2,870	810
Colorado	679	518	103	10.8	3.5	19	33	50	16.54	33.02	7,380	441
Connecticut	422	278	200	18.2	6.2	52	30	43	29.71	53.06	5,616	691
Delaware	91	69	190	18.7	6.4	27	50	41	29.64	40.15	4,220	1,398
Dist of Columbia	154	78	140	11.4	4.0	57	44	71	22.36	39.26	na	na
Florida	2,241	2,012	130	13.5	5.0	14	94	46	32.96	33.73	588	3,697
Georgia	1,161	1,058	160	19.8	7.0	14	67	39	26.00	32.40	2,688	1,943
Hawaii	180	117	150	11.9	3.9	17	29	42	95.63	101.64	na	na
Idaho	166	147	104	15.0	4.8	19	51	24	16.93	23.08	7,279	448
Illinois	1,481	1,043	140	16.1	5.5	47	26	46	16.09	34.54	6,047	975
Indiana	706	573	130	18.8	6.0	34	42	39	18.95	29.47	5,530	1,020
Iowa	313	227	120	17.9	5.3	41	37	44	19.09	30.67	6,930	880
Kansas	330	276	140	20.0	5.8	32	41	37	19.08	31.20	5,121	1,758
Kentucky	470	382	130	20.5	6.7	27	60	34	21.15	26.97	4,339	1,274
Louisiana	509	460	144	19.7	7.0	24	74	31	22.28	26.27	1,697	2,868
Maine	150	57	193	20.8	6.8	43	12	37	28.69	45.09	7,334	307
Maryland	670	493	160	13.9	4.6	29	51	56	26.55	39.02	4,558	1,267
Massachusetts	927	542	150	13.8	4.3	63	27	47	24.15	43.00	5,868	591
Michigan	1,008	710	150	19.3	6.8	38	18	44	18.44	38.91	6,698	682
Minnesota	542	292	100	12.1	3.8	31	33	59	18.29	32.13	8,481	554
Mississippi	282	251	150	23.8	8.1	18	69	28	24.39	29.80	2,479	2,280
Missouri	699	596	150	21.3	6.7	32	49	33	20.85	28.56	5,016	1,427
Montana	117	83	110	15.1	4.4	32	35	29	18.72	28.58	8,410	263
Nebraska	225	172	130	17.6	4.8	32	35	47	17.84	27.32	6,794	950
Nevada	415	374	130	14.1	4.5	6	48	44	22.26	34.02	3,981	1,876
New Hampshire	141	68	170	15.8	4.8	41	18	44	29.24	48.42	7,065	397
New Jersey	1,067	729	160	13.6	4.7	47	20	47	23.05	47.58	4,901	1,040
New Mexico	226	172	110	15.4	5.2	20	25	32	19.07	32.23	4,804	1,201
New York	3,224	1,444	140	13.6	5.0	59	15	61	25.52	53.52	5,616	808
North Carolina	1,141	1,015	140	18.8	6.0	17	75	35	25.80	30.06	3,268	1,633
North Dakota	88	50	80	12.0	3.0	27	55	56	18.97	25.16	9,448	434
Ohio	1,415	1,125	140	19.7	6.4	41	35	40	19.63	33.48	5,512	918
Oklahoma	434	378	150	22.1	6.7	24	50	33	20.16	27.75	3,655	2,456
Oregon	567	486	104	12.7	4.3	24	69	41	21.07	27.95	5,626	197
Pennsylvania	1,412	973	160	19.7	6.4	54	33	37	24.28	38.86	5,433	896
Rhode Island	157	90	180	18.2	5.4	69	15	39	25.48	42.01	5,423	654
South Carolina	489	437	150	20.5	7.0	17	81	34	28.23	32.40	2,604	2,081
South Dakota	92	59	110	17.0	4.7	27	42	47	19.59	27.42	7,948	769
Tennessee	738	645	150	20.5	6.5	19	77	37	23.26	29.25	3,652	1,552
Texas	3,101	2,694	140	16.4	5.0	13	76	50	25.92	32.48	1,863	3,308
Utah	258	204	110	13.3	4.3	22	16	39	13.78	26.27	6,890	720
Vermont	69	30	180	19.6	5.4	53	10	28	28.49	47.67	7,378	395
Virginia	923	731	140	13.8	4.4	20	63	46	24.73	31.19	4,014	1,310
Washington	941	797	100	10.8	3.4	22	76	46	19.64	24.26	5,929	155
West Virginia	168	136	130	22.2	6.6	31	59	30	20.21	27.52	4,814	927
Wisconsin	699	489	130	16.7	5.0	40	33	45	20.28	38.17	7,536	567
Wyoming	60	41	110	14.8	3.6	30	39	28	17.41	26.69	8,562	351
United States	**38,515**	**29,669**	**130**	**14.9**	**4.8**	**29**	**48**	**45**	**22.84**	**34.34**	**4,339**	**1,428**

Notes: Renters with utilities included in rent are excluded. Energy price is average for all sales to residential customers including homeowners. Degree days are weighted by population, and exclude Alaska, Hawaii, and the District of Columbia.
Sources: 2011 American Community Survey; 2011 DOE State Energy Data System; NOAA National Climatic Data Center.

It would be an overstatement to describe owners as having no interest in efficiency where tenants pay for utilities, or to say that tenants in properties with utilities included in the rent have no reason (other than concern for the environment) to conserve. Even in the absence of widely recognized measures of overall unit efficiency and likely energy costs, ads for rentals with tenant-paid utilities commonly include claims of energy efficiency, reflecting owners' recognition of the importance of efficiency to prospective tenants. In cases where utilities are included in the rent, landlords may encourage conservation in various ways and may decline to renew leases for tenants who are conspicuous energy-wasters. But without better measures and disclosures of efficiency and usage, market forces are unlikely to adequately address inefficiencies and ameliorate renters' energy cost burdens. Even with better information, there could be market failures.

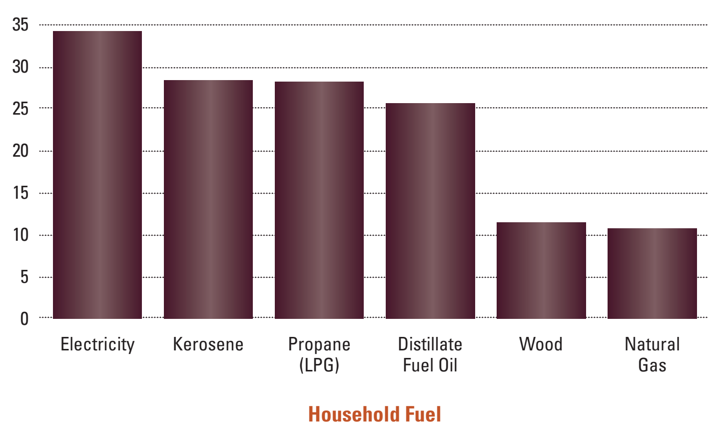
Over the past 30 years, market forces and public policy have focused on tenant behavior more than on investment decisions by installing individual meters in apartment buildings and requiring renters to pay their own utility bills. Some studies have found that residential energy use is less sensitive to changes in energy costs in the short run than it is in the long run. This has been interpreted to mean that investments in efficiency have greater impacts on energy use than changes in behavior (Austin 2012; Paul, Myers, and Palmer 2009).[3]

If energy-efficiency investments do in fact have a larger effect on consumption and on tenants' costs than changes in behavior, then billing renters rather than property owners for energy may contribute to energy cost burdens. The ideal situation, however, would be to encourage both energy-saving behavior and cost-effective investments in efficiency by aligning the interests of property owners and renters. Such an alignment can occur if renters paying for utilities are able to clearly distinguish the energy efficiency of different rental units and use that information in their housing choices. Property owners would then find greater revenue potential and competitive advantage in improving the efficiency of their rentals.

FIGURE 5

Energy Costs for Different Types of Fuel Vary Widely

National Average Residential Energy Price (Dollars per million BTUs)



Source: US Energy Information Administration, State Energy Price and Expenditures Estimates 1970 through 2011, Table E3.

OWNERS' INVESTMENT INCENTIVES

Property owners have incentives to invest in structural improvements and equipment that enhance energy efficiency if they expect such investments to increase revenues or reduce costs. Logic dictates that the potential for cost reductions is a greater incentive for property owners that pay for utilities than for those whose tenants pay the bills. The available data, however, make it difficult to determine the degree to which that difference in

3 In technical terms, the short-run price elasticity of energy demand from residential customers (assumed to represent behavioral change) is generally estimated to be less than half of the long-run price elasticity (assumed to include replacement of less efficient capital as well as behavioral change).

incentives affects investment in energy efficiency and energy usage.

The RECS data capture characteristics of renters and their housing, including features that affect energy efficiency such as insulation quality, window types, and the presence of Energy Star appliances. In cases where the tenant pays for utilities, usage data for those units were obtained from energy suppliers. If utilities were included in the rent, however, usage was imputed based on data for similar units where the tenants paid. This procedure effectively assumes that there is no difference in usage due to either tenant behavior or unit efficiency related to whether the landlord or the tenant pays for utilities.

The RECS data show that, consistent with the incentive structure, the presence of double- and triple-pane windows and tenants' positive assessments of insulation quality are more common in properties where the rent includes utilities than in those where the tenant pays directly. Upon closer examination of the data, however, the situation is more complex. Rents in areas with colder climates are more likely to include heat than in areas with milder winters, and homes in colder climates are more likely to be better insulated. Indeed, in regions with 4,000 or more heating-degree days per year, 45 percent of units in buildings with five or more apartments include heating costs in the rent. In regions with fewer than 4,000 heating-degree days, only 9 percent of units include heat in the rent.

The results of regression analysis that account for the effects of climate and structure age, as well as whether the rent includes heat, are ambiguous. No statistically significant effect on type of windows was found for the variable indicating who pays, although the effect on insulation and draftiness appears to be statistically significant. The insulation and draftiness measures are, however, based on the subjective assessments of the tenants, and tenants who do not pay for heat may be less critical of insulation quality.

The same types of incentives related to who pays for heat apply to questions about who pays for electricity and how that affects owners' appliance choices. Rents for about 20 percent of apartments in multifamily structures with five or more units include electricity for lighting and appliances. According to the RECS estimates, 43 percent of tenants whose electricity bills were included in the rent had Energy Star refrigerators, compared with 31 percent of tenants who paid for electricity themselves.[4] For dishwashers, the shares were 31 percent and 24 percent, respectively. For clothes washers, the shares were 55 percent and 39 percent, and for room air conditioners 58 percent and 48 percent.

However, when using regression analysis to examine the relationship between the presence of Energy Star appliances to who pays for electricity—including other variables such as the age of the housing structure, age of the appliance, and size of the household—a significant relationship to who pays the bill was found for refrigerators, but not for the other appliances.

Davis (2010) compared the penetration of Energy Star appliances in owner-occupied housing with the penetration in rental housing where tenants paid for utilities. He found a significantly higher presence of Energy Star appliances in owner-occupied units, after adjusting for other factors. In the one section where that analysis included rentals with owner-paid utilities, he did not find that they were more likely than other rentals to have Energy

4 This includes only cases where the appliance was present and was less than 10 years old, and where the respondent reported whether or not it had an Energy Star label.

Star appliances. In short, the available evidence that landlords are more likely to make energy-saving investments when they bear more of the energy costs is not as strong as the incentive theory implies.

The lack of stronger statistical evidence linking energy features to the inclusion of utilities in rents may be partly attributable to weaknesses in the data, but it does suggest that energy inefficiency in the rental housing stock is due to more than split incentives. Investments to improve efficiency may be constrained by limited financial resources, and perhaps limited sophistication, among the owners of the older, smaller properties where energy efficiency is especially problematic. Such properties are generally owned by individual "mom and pop" investors that may not have the capacity to make energy improvements.

TENANTS' ENERGY-USING BEHAVIOR

Using RECS and AHS data for 1997, Levinson and Niemann (2004) attempted to measure the effect of including utilities in rent on the energy-using behavior of tenants. Since RECS does not have actual energy consumption data for tenants who do not pay the bills, they used data measuring the thermostat settings and other behavior reported by tenants who did and did not pay for utilities. They then translated that information into energy usage and expense based on engineering calculations.

After adjusting for factors such as climate, unit size, and the number and demographic characteristics of household members, the authors estimated that the additional fuel that unmetered households used for heating amounted to less than 2 percent, mainly because those tenants were less likely to lower the thermostat setting when they left home. Although the study does not directly calculate additional usage for purposes other than space heating, the authors suggest that a reasonable estimate of the overall effect of including energy costs in the rent is to raise energy use by about 2 percent of total household consumption.

Other studies have found more substantial differences in usage and energy-using behavior depending on who pays utility costs. In a review of several analyses, a report by Booz, Allen, and Hamilton (1979) concluded that individual metering and separate billing reduced electricity consumption by 15–20 percent. The effects on gas usage were smaller, with separate billing reducing consumption by 5–7 percent, and with some studies showing higher usage with individual gas meters.

Munley, Taylor, and Formby (1990) report on electricity usage in an all-electric apartment complex in the Washington, DC, area where some tenants paid for electricity and others had the costs included in rent. They found that tenants who did not pay for usage consumed 32 percent more electricity, on average, than those who paid directly. Maruejols and Young (2011) report that average energy usage by Canadian tenants of low-rise apartments was more than twice as high as when utility costs were included in the rent. They caution that the usage data were largely imputed and suspect. More reliable data in the same survey showed differences in thermostat settings and whether tenants washed clothes in cold or hot water depending on whether renters paid for energy costs, but not to an extent that would suggest such large differences in energy usage.

Thus, the energy used by tenants with utilities included in the rents is both logically and empirically greater than if they paid directly for energy. But the extent of additional usage due to tenant behavior, and how that compares with the potential savings from investments in efficiency, are open questions.

INDIVIDUAL METERING AND PUBLIC POLICY

Reflecting government efforts to reduce energy consumption and oil imports for "the protection of public health, safety and welfare, [and] the preservation of national security," the 1978 Public Utilities Regulatory Policy Act (PURPA) called for state regulators to require most new apartments to have individual electricity meters. But it also provided that "nothing in this subsection prohibits any state regulatory authority or nonregulated electric utility from making a determination that it is not appropriate to implement any such standard, pursuant to its authority under otherwise applicable state law." States could thus interpret the mandate for individual electricity meters in new buildings as a suggestion rather than a rule, and not all states adopted the policy.

Many newer buildings still have master meters (or have individual meters but the tenant does not pay the bills). According to 2011 American Community Survey (ACS) data, about 12 percent of apartments in structures with two or more units built after 1980 had electricity included in the rent, compared with 17 percent of those built earlier. The share of newly built rentals with electricity included might have declined even without PURPA or state policies, just because of owners' choices. The share of new gas-heated apartments where the rent included gas costs has also decreased, even though PURPA did not call for that.

It is more common for tenants to pay for electricity than for gas or oil, reflecting easier metering and easier installation of electric heating equipment in individual units. The share of new rental apartments with electric heat increased after 1980, while the share with gas or oil heat declined. That shift to electric heat, as well as to individual billing for electricity and gas, expanded the share of renters paying directly for their heating costs.

The 2011 ACS indicates that 71 percent of renter-occupied units in structures of five or more units built in 2000 or later had electric heat, up from 63 percent in the 1970s. In contrast, the share of owner-occupied units in comparable structures with electric heat fell from 66 percent for units built in the 1970s to 49 percent among those built in 2000 or later.

SOLUTIONS TO SPLIT INCENTIVES

Possible mechanisms for addressing the split-incentive problem, overcoming other influences that constrain improvements in energy efficiency, and reducing energy cost burdens include three types of initiatives: (1) subsidizing investments in efficiency, (2) adding regulations that mandate efficiency standards, and (3) making energy efficiency and costs more transparent, so that households can consider that information in choosing a place to rent and property owners can identify cost-effective investments.

Government- and utility-delivered subsidies can overcome the split-incentive problem in rental housing by bridging the gap between the value of savings to tenants and the value to property owners who do not pay the energy bills.

A variety of efforts have been made to use subsidies to stimulate investment in energy efficiency—mainly by government agencies (at the expense of taxpayers) and by utilities (at the expense of other customers). Government- and utility-delivered subsidies can overcome the split-incentive problem in rental housing by bridging the gap between the value of savings to tenants and the value to property owners who do not pay the energy bills.

Government subsidies, often in the form of tax credits, have generally focused on reducing aggregate energy consumption for environmental, macroeconomic, and national security reasons, rather than on reducing energy cost burdens. One exception is the Department of Energy Weatherization Assistance Program, operating since 1976 and temporarily expanded as part of the 2009 American Recovery and Reinvestment Act (ARRA). Even though the program explicitly targets low-income households (below 200 percent of the poverty line) and more than half of the households meeting this criterion are renters, support has primarily gone toward retrofits of owner-occupied housing.

Demonstrating the low-income status of their tenants is a barrier for rental property owners, in part because privacy rules may prevent them from getting that information. Following the 2009 expansion of the program under ARRA, however, procedures were developed to facilitate use of the Weatherization Assistance Program in HUD-subsidized and Low Income Housing Tax Credit (LIHTC) housing, where occupants are required to have low incomes. Nevertheless, subsidies for energy upgrades of market-rate rental housing occupied by low-income households remain limited.[5]

For their part, utilities promote energy efficiency by offering rebates on purchases of energy-efficient equipment, providing free or subsidized energy audits, and arranging or subsidizing structural improvements to building efficiency. These programs are usually mandated by state public utility commissions and funded by utility customers (Johnson and Mackres 2013, McKibbin 2013). In 2011, spending on utility efficiency programs amounted to almost $7 billion (Foster et al. 2012). The efforts of utilities to reduce demand, especially during peak-load periods, are an alternative to adding new high-cost generating capacity or wholesale energy purchases. These demand-side management programs may help to ease renters' energy cost burdens, although that is not their main purpose. And despite a recent push to extend utility programs to multifamily housing, most initiatives focus on owner-occupied single-family homes and commercial buildings.

Regulations are a powerful but blunt tool for improving energy efficiency. Building codes set standards for the construction of new buildings and structural improvements to existing buildings. State and local governments typically adopt building codes based on model codes fashioned by quasi-official committees. Regional councils created model energy codes as early as the 1970s, although few local jurisdictions initially adopted those standards. After the International Code Council was established to supplant the competing regional code groups, it created the International Energy Conservation Code—an increasingly comprehensive and stringent model for energy requirements in local building codes (Deason and Hobbs 2011).

Construction requires permits, plan reviews, and possibly rigorous inspections. Changes in building codes, if enforced, could have profound effects on rental structure characteristics. But new construction and substantial remodeling affect only a small share of the housing stock each year, and it would take decades for a change in building codes to have a meaningful impact on the overall efficiency of the rental inventory.

Regulations mandating efficiency are not without cost. Stringent building codes raise

5 There is also a federally funded Low Income Home Energy Assistance Program to subsidize utilities expenses for low-income households. While helping to defray energy cost burdens, it does not address the split-incentive problem or promote investments in efficiency.

FIGURE 6

Energy Cost Labels Can Help to Inform Renters' Choices

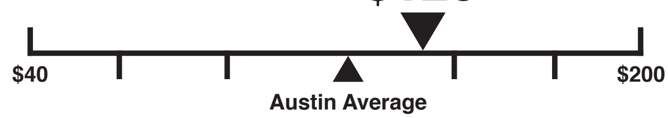
2012

Austin City Code Chapter 6-7, Energy Conservation

ENERGY GUIDE

FOR PROSPECTIVE TENANTS

ESTIMATED MONTHLY ELECTRIC COST **$120**



THIS PROPERTY

This graph above represents the range of electric costs for Austin properties of a similar type to this one.

This property is:

- all electric
- built before 1985
- 800 sq. ft. average apartment size

Cost information:

- is based on this facility's average size apartment,
- based on a cost of $0.10 per kWh, and
- is updated annually.

1,200 kWh

ESTIMATED MONTHLY ELECTRIC USE

For details, visit the web site austinenergy.com/go/ECAD, call 482-5278 or see QR Code:

YOUR BILL

Your actual bill will depend on many factors:

- Weather (bills are higher in extreme heat and cold – especially if electric heat is used),
- Thermostat settings,
- Number of occupants,
- Lifestyle habits,
- Size and location of unit (upper floors and south and west facing units are generally warmer),
- Energy efficiency measures in place, and
- Age and type of heating/cooling equipment.

ENERGY AUDIT RESULTS FOR THIS PROPERTY:

4321 APARTMENT AVENUE, AUSTIN, TX 78700

STREET ADDRESS

ENERGY EFFICIENCY MEASURES EVALUATED	AUSTIN ENERGY RECOMMENDS	AUDIT RESULTS (AVERAGED)
Air Duct System	Less Than 15%	44% Leakage
Attic or Roof	Between R22–R30	R-14
Solar Screens or Window Film	On all East, South and West Windows	Complete

"Average" values are calculated from results obtained from multiple buildings and systems.

CONSTRUCTION YEAR: 1978, 1982 ENERGY UTILITIES: All Electric ENERGY AUDIT CONDUCTED BY: A Qualified Auditor

NUMBER OF UNITS: 57 DATE OF ENERGY AUDIT: September, 2011 DATE OF DISCLOSURE NOTICE: June 30, 2011

I acknowledge that I have been given an opportunity to review the results of this multi-family property's energy audit conducted in accordance with Austin City Code, Chapter 6-7.

Signature/Date

Owner's Representative

Signature/Date

Source: Austin Energy www.austinenergy.com/About%20Us/Environmental%20Initiatives/ordinance/ECADMFEnergyGuideFormcombo.pdf construction costs and therefore the rents for new housing. These cost increases put upward pressure on all rents, even though stricter codes do not directly improve the energy efficiency of older structures that do not undergo major remodeling (Listokin and Hattis 2005). Still, setting higher standards for new buildings, as well as for appliances, may stimulate development of more efficient products and reduce the cost of improving the efficiency of existing structures.

Housing codes that set health and safety standards for occupied housing are much more limited than building codes, and are largely concerned with standards of maintenance.[6] There have been some exceptions where the codes impose obligations for updates to properties, such as retroactive requirements for smoke detectors. Enforcement is haphazard, however, and inspections typically occur only as a result of complaints from tenants or neighbors.

With better measures of efficiency, as well as of the relationship between efficiency and rental demand, property owners would be more likely to invest in energy-saving improvements.

Another form of regulation requires disclosure of information about properties that are sold or leased. For example, home sellers and/or lessors may be required to disclose the results of lead or radon tests.[7] This type of regulation applied to energy, and involving both measuring and disclosing efficiency, could be a key to overcoming the split-incentive problem and reducing renter cost burdens.

A handful of communities—notably Austin, New York City, Seattle, and the District of Columbia—have enacted regulations requiring energy audits, benchmarking, and/or disclosure for multifamily rental properties (Krukowski and Burr 2012).[8] Because these programs have not been fully implemented, it is difficult to assess what their effect will be and whether such policies will be adopted more widely. Even with information from energy audits and benchmarks, though, it may be difficult for tenants to understand the results and incorporate the information as they search for a place to live. Austin's "energy guide," similar to the labels on appliances, may facilitate use of the information **(Figure 6).**

Providing better information to renters may help them in making choices among available places to live, but stimulating investments in efficiency that can benefit all renters requires that property owners also have better information—about their properties' efficiency, potential improvements, and the impact of efficiency on revenue and costs. Indeed, building owners may not know how much energy their tenants consume, and utilities may be precluded from providing that information because of privacy restrictions. Some utilities, under instructions from regulators, have provided aggregate tenant usage for entire buildings to avoid disclosing unit-level data. Information about how energy use in a particular building compares to that in similar properties is also valuable, but is often unavailable.

6 Although existing structures may not be required to have energy-efficiency improvements, when the appliances in those structures are replaced, federal regulations for that equipment will produce some increase in efficiency.

7 See www2.epa.gov/lead/real-estate-disclosure

8 An energy audit is a detailed analysis of a building's energy characteristics, including insulation, heat leaks, and equipment. Benchmark is a term used to describe comparisons of energy use with other buildings (also referred to as rating). Software packages, such as Portfolio Manager from EPA's Energy Star, are typically used in benchmarking.

In the course of supporting retrofits, government agencies and utilities typically collect detailed information about the effect of upgrades on energy consumption. In general, though, they do not collect information about vacancy rates, tenant turnover, and rent levels before and after the improvements. That is the sort of information that would allow property owners to clearly see the value of reducing tenants' energy costs. Moreover, with better measures of efficiency, as well as of the relationship between efficiency and rental demand, property owners would be more likely to invest in energy-saving improvements and to advertise the results of energy audits and benchmarks—with or without a regulatory requirement to do so.

THE ENERGY PARADOX

Even in owner-occupied housing, investments in energy efficiency do not match the levels that cost-benefit calculations would imply. Indeed, homeowners often do not take even the most obvious steps to improve efficiency, apparently requiring extraordinary rates of return on their investments. Researchers have referred to this as the energy paradox or the energy efficiency gap (Hausman 1979; Sanstad, Blumstein, and Stoft 1995; Ansar and Sparks 2009; Metcalf and Hassett 1999; Jaffe and Stavins 1994; Meier and Whittier 1983; Fuller 2009).

Some analysts have questioned the notion that homeowners' reluctance to invest in energy efficiency is irrational and whether projected savings would be achieved in practice (see, for example, Allcott and Greenstone 2012). But the experience on the owner-occupied side suggests that even without the conflicting interests, asymmetric information, and uncertainties of the landlord-tenant relationship, the full potential for cost-effective investment in energy efficiency in rental housing might not occur. Still, given the size of renters' energy cost burdens, overcoming market failures that contribute to high energy expenses could make a significant difference in the lives of millions of low-income Americans.

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