using but still highly agreeable patterns of human life is still a high priority. On the other hand, we should not delude ourselves with false hopes. There are better ways and worse ways of being poor, and obviously the better ways are to be preferred. A lack of energy input, however, means poverty and it is hard to blame people for not liking it, even when it is the best kind of poverty that can be devised. One is particularly suspicious of good advice from the rich to the poor on how they can make the best use of their poverty.

It is pleasant to speculate whether the energy shortage will produce changes in the family (the New York blackout was followed by an increase in the birthrate 9 months later); in religion, for surely contemplative religion is the least energy-using form of human activity; in politics, for surely a whole new set of symbols will be appropriate to the present crisis; and so on. I must confess I am skeptical of any such projections. If indeed the automobile is replaced by public transportation, this will turn our cities outside in as the automobile turned them inside out, and we will return to the ecological patterns of the cities of 1880. I am not sure that even this would be a massive social change. The fact is that the energy requirements of all the various activities of a complex society are sufficiently similar so that a rise in the price of energy, although it will produce some structural changes and some income distributions, is likely not only to be offset by countervailing technical changes but may also be very widely diffused. We may all be a little poorer than we would have been if energy had remained cheap, but, if economizing in energy as well as in other inputs continues, we may continue to get richer, at least for a while.

There are, furthermore, other prospects looming on the horizon, such as a food shortage, which may have much more drastic effects than the energy shortage, though they may in part be consequences of it. Oil indeed may be more important in the future as a source of fertilizer than it is of gasoline, and we are already beginning to see some indications that this may be the most drastic impact of an oil shortage. In the long run materials may be more intractable than energy, although the two are closely related. I confess that I am more worried, looking at the next 30 years, about possible ecological instabilities in developed agriculture, dependent as it is on fuel, fertilizers, monoculture, and constant genetic innovation, than I am about possible curtailments of energy input into private transportation or even manufacturing. The latter does not seem to threaten more than inconvenience. A collapse of developed agriculture, however remote the possibility seems today, threatens major disaster for the human race, with a probability, especially over the next two or three generations, that cannot be put at a comfortable zero.

Evolution of Public Response to the Energy Crisis

James R. Murray, Michael J. Minor, Norman M. Bradburn, Robert F. Cotterman, Martin Frankel, Alan E. Pisarski

Social scientists are usually in the position of lamenting the absence of systematic data that would allow them to know how the public is reacting to events and what social adaptations, either constructive or destructive, are occurring or likely to occur. As the energy crisis began to move from a topic of discussion and dire prediction to a concrete reality, we have been, for the first time, in a position to examine an important event as it occurred. Through national probability sample surveys, we have detected the spread of the energy crisis throughout the nation and measured the changes in behavior and attitudes of the public as they encountered energy shortages. This assessment has been made through the Continuous National Survey (CNS), a small weekly nationwide probability sample of the U.S. population conducted since April 1973 by the National Opinion Research Center (NORC) at the University of Chicago. The CNS program was designed to provide multiple federal agencies with data relevant to program and policy issues. The data presented here were collected to provide the Department of Transportation and the Federal Energy Office with current information on the impact of the energy crisis. We have been providing reports to these agencies within 10 days of each interviewing week on these energy data since the first week of December.

In this article we present some of our major findings related to public exposure and reaction to the developing energy crisis since November 1973, when the American public began to experience shortages of gasoline and other oil end products.

The general picture that emerges from the survey data is that while a majority of the public consider the energy shortage an important problem, only about 25 percent feel that it is the most important problem facing the country today. The public shows some understanding that there is a problem with all types of energy, but experience with actual shortages has been dominated so far by shortages in gasoline, and reactions appear to be largely conditioned by these experiences. Nevertheless, there has been little support for gasoline rationing, although there is some indication that this view may have been changing at the end of February.

Agreement is widespread that responsibility for the energy crisis lies most heavily on the federal government and the oil companies, and there is little tendency to blame Arabs, Israelis, environmentalists, or individual consumers. There is also a prevailing senti-

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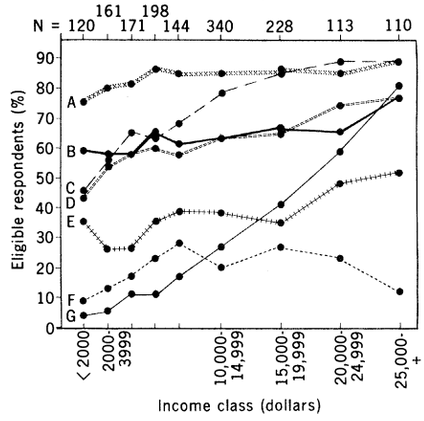
Fig. 1. Conservation measures, exposure to shortages, and appliances owned according to income class (cumulative results for the interviewing period). (A) Trying to cut electricity use. (B) Cut driving. (C) Have clothes washer or dryer. (D) Reduced temperature this winter. (E) Had trouble getting gasoline during the past month. (F) Washer or dryer owners cutting use of the appliance. (G) Have dishwasher.



ment that the federal government is not handling the situation well. While a large majority report that the energy shortage has changed their way of living somewhat, the changes have not yet been perceived as major. In early January, when experiences with gasoline shortages were still not widespread or serious, about as many reported that the changes in their lives had been for the better as that they had been for the worse. However, at the end of February there was an increase in reports that the changes were predominantly for the worse and some evidence of greater annoyance and anger.

Since the Arab boycott and the President's nationwide television appeal in early December, there have been pervasive but modest efforts at energy conservation on the part of most segments of the public. However, these efforts have not yet gone beyond saving a bit here and there. There is little indication of any serious change in lifestyle, such as changing the mode of transportation to work or increasing the average occupancy of cars on the trip to work. People still are very resistent to car pools.

So far, the public has been cooperative in efforts to conserve energy, but not yet fully convinced that we must seriously restructure our high energy consumption way of life. A majority of the population believe that we will have as much energy as we need within 5 years.

Exposure

Fuel oil. Homeowners who utilize fuel oil to heat their houses ($N = 331$) were asked about problems with the purchase of fuel oil last winter (1972–1973) and with their last purchase this winter (1973–1974). Only 1 percent reported problems in the winter of 1972–1973, and less than 3 percent reported difficulties during their last purchase this winter. Hence, despite predictions about heating fuel shortages, there was a very low incidence of problems in purchasing fuel oil in the past 2 years.

Electricity. All respondents ($N = 1946$) were asked to report problems with obtaining electricity in the past year. Only 5 percent indicated experiences with electrical problems such as brownouts and power failures. Although a few respondents from all areas of the country reported such difficulties, the highest incidence occurred in the New England region, where 23 percent reported experiencing electrical problems in the past year.

Gasoline. The percentage of car-owning households that reported trouble getting gasoline in the past month increased more than threefold (from 17 to 56 percent) in the 3-month interviewing period. There is a significant positive monotonic trend in the rate of reported difficulties throughout the interviewing period, except for the last few weeks, when the incidence of problems appears to have stabilized around 56 percent. The largest single increase in experienced difficulties occurred over the Christmas holidays (21 to 37 percent).

Analyses by census regions indicate that in February the highest incidences of gasoline problems were reported from the Pacific Coast (83 percent) and New England (82 percent). These regions had the highest percentage of respondents reporting this difficulty from December through February. The percentage in the Rocky Mountain region (20 percent) has remained fairly stable; in the South Atlantic and West Central regions, there have been sixfold (10 to 60 percent) and fivefold (11 to 57 percent) increases, respectively.

Figure 1 shows the distribution of difficulties in getting gasoline over income classes for the entire 3-month interviewing period. The relation between trouble getting gasoline and income class remains similar even if households are separated by area of residence (metropolitan or nonmetropolitan); the metropolitan curve is merely an upward translation of the nonmetropolitan curve (the overall percentages are 39 and 32, respectively). Similarly, correction for the number of cars owned by the household does not essentially alter the relation; the curves are the same shape for one-car and for two-car households (overall percentages, 30 and 40, respectively) as for all households together.

If a member of the household did experience problems obtaining gasoline, the respondent was asked to state the type of problem encountered. Although the incidence of all types of problems increased monotonically during the last 3 months, the two most pervasive difficulties were gas stations being out of gas and gas stations not

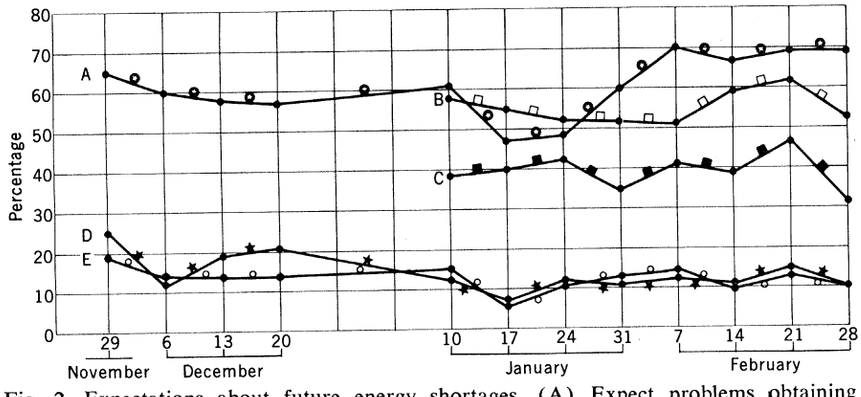


Fig. 2. Expectations about future energy shortages. (A) Expect problems obtaining gasoline in the next year. (B) Feel the shortage will affect them seriously in 6 months. (C) Feel the shortage will affect them seriously in 5 years. (D) Homeowners who expect problems obtaining fuel for heating in the next year. (E) Expect problems obtaining electricity in the next year.

Despite reports of cutting down on driving, commuters show no tendency to switch from the single-passenger auto trip to public transportation, according to weekly surveys conducted by the National Opinion Research Center. [Photographs by Eric Poggenpohl, *Science*]

being open as much (75 percent in February for each item). In February, approximately 50 percent reported problems related to getting as much gas as they wanted or to waiting in line. There is a large week-to-week variation in reports of when these problems occurred; however, an average of 70 percent reported encountering problems between Monday and Friday. In February, 15 percent reported that gas stations had gone out of business.

It is worth noting that exposures to different energy shortages across domains—gasoline, heating fuel, or electricity—are not significantly related.

Expectations

Expectations are particularly important for analysis from a social science perspective, because they generally reflect not only previous experiences but also assessments about current situations and anticipations of future events. Respondents were asked questions about three distinct types of expectations: (i) Did they expect to have difficulty getting gasoline, heating fuel, or electricity within the next year? (ii) How seriously did they expect to be affected by energy shortages in 6 months and in 5 years? (iii) How many years did they think it would be until "we have as much energy as we need"?

Figure 2 shows the percentage of respondents expecting difficulty getting heating fuel, gasoline, or electricity in the next year. For gasoline, there is a sharp drop in the middle of January, followed by an increase of about 20 percent in February, reflecting the relative increase in the availability of gasoline after Christmas and the unexpected decrease at the end of January. The low level and slight downward trend in the heating fuel curve reflect the relatively mild problems encountered by the public early in the period and their diminution as time went on. The relative increase in this curve before Christmas was undoubtedly due to the government's highly publicized fears of "unheated homes." Respondents reporting difficulty obtaining fuel are twice as likely to expect further problems over the next year as those not reporting difficulty. Furthermore, there are "transfer effects"; that is, exposure to problems with one type of fuel, such as gasoline, increases the expectation of problems with other types of fuel, such as electricity or heating fuel.

Expectations about the seriousness of the energy shortage in 6 months and in 5 years are also presented in Fig. 2. Most respondents perceive the short-term effects as more serious than the long-term effects (54 and 40 percent, respectively). Exposure to gasoline shortages is positively related to expectations for 6 months but is unrelated to expectations for 5 years from now. Thus, the February rise in the percentage of respondents expecting serious problems in 6 months is due to the increased difficulty in purchasing gasoline in this period.

Respondents' estimates of the number of years until we have as much energy as we need are close to the estimate given by the government as the goal for attaining "energy independence." In fact, the median of the estimates indicates that the public expects an absence of energy shortages before 1980. The estimate of the number of years until energy sufficiency, like the expectation of the seriousness of problems in 5 years, is unrelated to exposure or other expectations.

These findings lead us to conclude that there are two types of expectations. Short-term expectations are influenced by exposure to shortages, and themselves determine evaluations and conservation behaviors. Longer-term ones are insensitive to recent experiences of shortages, relatively stable over time, and unrelated to evaluations of the energy shortage and conservation behaviors.

Clearly, the public believes that fuel shortages are not inevitable in the future and will most likely be solved within 4 or 5 years. This relatively optimistic public stance is further indicated by the finding that the median estimate of the price of gasoline after 1 month of free market conditions is $0.75 per gallon.

Personal Reactions

Despite highly publicized protests about the "unfairness" of fuel allocations, 95 percent of the respondents considered that they were receiving their fair share of fuel for home and transportation use. This percentage remained stable over January and February, and therefore appears to be insensitive to changes in levels of exposure.

Although most respondents thought they were receiving a fair share of

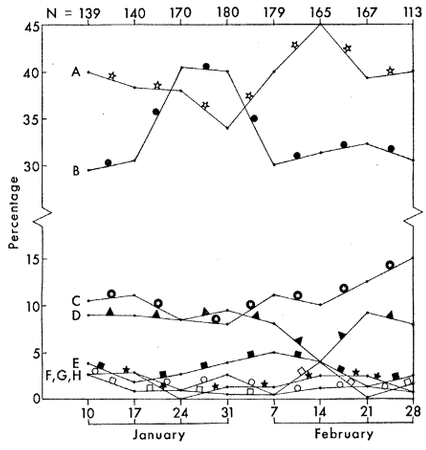


Fig. 3. Which group is most responsible for the current energy shortage? (A) Government in Washington. (B) Oil and gas companies. (C) Arabs. (D) Big business. (E) Individual consumers. (F) Russians. (G) Israelis. (H) Environmentalists.

fuel, 25 percent reported that they were suffering more than people of other income levels because of the energy shortage. This reaction is negatively related to household income and unrelated to exposure, and hence may reflect general attitudes that higher-income households suffer less. Of course, our data only indicate the occurrence of problems and not their severity. Therefore, although the incidence of problems is greater in the higher-income households, the impact of the problems could be greater for the lower-income ones.

There has been a significant decrease in the percentage of car owners who felt they were able to use their cars as much as they wanted. These feelings were at the highest level (70 percent) during the third week in January, but decreased linearly to 38 percent during the last week of February. The relation between reactions about the amount of car use and exposure to gas shortages is significant. Reaction about amount of car use is also significantly related to satisfaction with the amount of use. A curve of the percentage reporting "completely satisfied" (mean = 48 percent) is an exact downward translation of the "amount of use" curve, and a curve of the percentage reporting "not at all satisfied" is an exact reflection of the "amount of use" curve, with a mean of 10 percent.

The percentage of respondents who reported that there were changes in their lives because of the energy shortage increased significantly (from 64 to 79 percent) during January and February. During the first 2 weeks in January, respondents were equally divided between those who felt these changes were for the better and those who felt they were for the worse. Since the third week in January, however, there has been a significant shift in these proportions. We believe that those seeing changes initially as for the better were reacting to the novelty of the sudden onset of shortages; however, as problems became more pervasive and short-term resolution less certain, the percentage of negative evaluations increased. Weekly estimates of the strength of the feelings of respondents who reported negative life changes show that during the second and third weeks in February the percentage expressing annoyance or anger increased significantly to 73 percent.

Sixty-seven percent of the February sample expressed the belief that the gasoline shortage could be solved if individual consumers cut down on gasoline consumption. While there were no major differences in this percentage when respondents were categorized by demographic characteristics, a higher percentage (78) of respondents who resided in farm or rural areas believed in the effectiveness of individuals. There is no relation between support for this belief and exposure to gasoline shortage. This finding may represent higher levels of self-reliance or self-sufficiency in farm or rural areas.

These personal reactions are not significantly interrelated. Belief in the ability of individual consumers to solve the energy shortages is significantly related to reports of cutting down on driving and turning off of lights. Reports of life changes are positively related to the evaluation of the importance of the energy shortage as a problem. While expressions of feelings of inequity concerning the fuel distribution system were rare, we believe that the high rate of negative perception of life changes, with attendant feelings of hostility, provides a context for public disturbances and violence if perceptions of inequity were to increase dramatically.

Evaluation

The importance respondents attach to the energy shortage as a national problem has been fairly stable. The overall estimates for the 3 months of interviewing are: most important, 26 percent; very important, 59 percent; fairly important, 14 percent; not a problem, 8 percent. Two findings about these evaluations should be emphasized: (i) The public is aware of the energy shortages, as only 8 percent do not think the shortages are a problem. The majority, however, do not view these problems as the most important in the country. (ii) In the last 2 weeks of February there was a significant increase (to 32 percent) in the percentage of respondents who think the shortage is the most important problem.

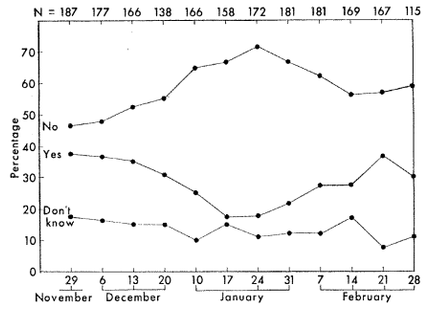


Fig. 4. Is gasoline rationing necessary?

An analysis by demographic characteristics shows that opinions concerning the importance of the energy shortage are not significantly related to region, education, income, or area of residence. However, they are related to expectations of problems in obtaining gasoline and electricity and to reports of a change in life-style due to the energy shortages. We found that exposure to gasoline problems was not related to the evaluations of importance in November, December, or January, but was significantly related in February. This suggests that the evaluations do not become articulated with behavioral events (exposure) until the duration of the situation (shortages) and the pervasiveness of the events have reached a certain threshold.

Weekly results concerning assignment of responsibility for the current energy shortage to various groups are presented in Fig. 3. Although there is some variation, the rank orderings of groups remain fairly stable across the 2-month period. The government in Washington is perceived as the most responsible (mean = 40 percent) throughout the interviewing period, except for the last 2 weeks in January, when the oil and gas companies were perceived as the most responsible group. This sudden and brief reversal of order is best explained by the disclosure during that period of the high profits of the major oil companies. Of the other groups, all but the Arabs and big business were seen as most responsible by

less than 5 percent of the sample. These evaluations of responsibility are unrelated to any other variables, such as exposures, expectations, or demographic characteristics.

Changes in the weekly ratings of the performance of the national and state governments in handling the fuel shortages suggest two significant trends: (i) In February there was a significant increase (to 44 percent) in the number of respondents who thought the state government was doing a good job (the baseline level in January was 36 percent). (ii) During the last 3 weeks in February, there was a significant increase (49 to 58 percent) in the number of respondents who thought the national government was doing a poor job (the baseline in January was 53 percent). Throughout January and February there was a significant difference in mean levels between state and national governments in the ratings of "good performance" (38 and 16 percent, respectively). The ratings of government performances are unrelated to any demographic characteristics or other variables.

Policy Preferences

Since July 1973, we have collected data about the public's preferences with respect to allocation priorities, gas rationing, and daylight savings time. The opinions of the respondents about allocation priorities, presented in Table 1, are best summarized by three statements: (i) The order and magnitude of the preferences have been stable over an 8-month period. (ii) An overwhelming plurality (mean = 42 percent) consider farm vehicles as the first choice to receive fuel. (iii) The priorities voiced by the public are very similar to the government's allocation priorities.

There are some interesting week-to-week variations in opinion about who should get fuel first. The most significant variation is in the percentage of respondents favoring trucks, which increased steadily from 24 January to 14 February, reflecting the well-publicized actions of the truckers during that period. Hence, athough support increased for only a few weeks and subsequently declined, the findings suggest that public preferences are sensitive to certain events.

Two types of questions were used to gather opinions on rationing issues. First, a series of paired comparisons measured preferences for gasoline rationing over alternate plans that included increased prices. The findings were stable from November to February, with 73 percent of the respondents preferring rationing at $0.50 a gallon to the other alternatives with higher prices. Second, respondents were asked whether they felt gas rationing was necessary. The results of these findings are presented in Fig. 4. Two statements best characterize these data. First, the population has definite attitudes about rationing, as evidenced by the low percentage of "don't know" responses. Second, the percentage opposing rationing significantly increased in early January, but began a steady linear decrease by the third week in January.

The complex weekly fluctuations in these opinions are a result of at least three factors. The first factor is the respondent's prior experiences with and knowledge about rationing. In the first few weeks of the publicized energy crisis, there were numerous references to World War II, when rationing "wasn't all that bad"; in January, however, when high government officials expressed opposition to rationing, the public showed a concomitant response against rationing. The second factor is the respondent's exposure to gas shortages. Exposure was unrelated to feelings about the necessity of rationing in December and January, but was significantly related in February—if one experienced difficulty getting gas he was more likely to favor rationing. The third factor is the respondent's expectations of gas problems. Expectations of problems were significantly related to opinions about rationing in January and February, but not in December. Hence, if experiences and expectations of shortages become less pervasive, we predict that the percentage of respondents favoring rationing will decrease.

Four other findings related to rationing issues are of interest: (i) 50 percent of the respondents thought that people in some regions of the country should get an extra amount of gas rations; (ii) 90 percent thought that people living in areas with little or no public transportation should get extra ration coupons; (iii) 84 percent thought that people who use their cars for business should get extra ration coupons; and (iv) 76 percent thought that ration coupons should expire at the end of 1 year.

Opinions about daylight savings time have been collected every month since August 1973, except for January 1974. Before the enactment of legislation calling for year-round D.S.T. by Congress, the data showed high levels of public support for the plan. After D.S.T. was begun in January, we found a majority disliking the plan. However, the ques-

Table 1. Policy preferences.

Use of fuel or type of vehicle	Respondents (%) giving as first choice in			
	Feb. 1974	Jan. 1974	23 Nov.–20 Dec. 1973	July 1973
If there is not enough fuel for everyone, which uses do you think are most important?				
	(N = 643)	(N = 679)	(N = 670)	(N = 612)
Heating homes	56	60	59	61
Farming operations	59	59	56	55
Factory operations	50	46	41	42
Commercial freight transportation	37	35	29	30
Mass transit	33	31	28	27
Business driving by private citizens	23	24	19	17
Pleasure driving	1	1	1	1
National defense	51	50	*	*
If the government must ration motor fuel, which type of vehicles should get it first?				
	(N = 638)	(N = 675)	(N = 664)	(N = 596)
Farm work vehicles	40	44	39	47
Private cars	12	17	16	11
Urban mass transit	13	14	14	19
Trucks	17	11	9	6
Railroad freight trains	10	6	9	7
Buses for between-city trips	3	2	4	3
Commercial airlines	1	2	2	2
Passenger trains for between-city trips	2	1	2	1
Private airplanes	0	1	0	1
Taxis	1	0	1	2
Construction vehicles	1	0	1	1

*The question was not asked.

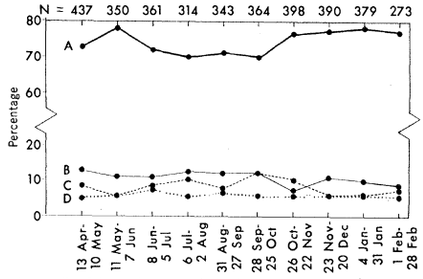


Fig. 5. Usual mode of transportation to work. (A) Car, driver. (B) Car, passenger. (C) Walk (or bicycle, motorcycle, work at home). (D) Public transportation (bus, train, subway, or taxi).

tion asked was changed from a yes/no response alternative to the proposal for year-round D.S.T. to a like/dislike response to the new legislation. We are now collecting additional data to resolve the ambiguity between item and temporal change. That is, Is approved similar to liking, or did the public really shift in feeling after the change to D.S.T.?

Conservation

Thermostat setting, lighting, and major appliance usage were taken as measures of household energy consumption. Overall, from last winter (1972–1973) to this winter (1973–1974), few report increased daytime temperatures and reduction rates are nearly uniform from −1° to −9°F. Table 2 shows the distribution of heating units according to the 1970 census and our CNS sample. The last column shows the percentage of households, for each fuel type, reporting a daytime temperature setting this year that was less than the setting last year. The highest rate occurred for the fuel currently in shortest supply, fuel oil. These temperature reduction rates have been stable from November 1973 through February 1974. The median weekly reported daytime temperature this winter was 68°F. There were only minor weekly variations in the reports of last year's daytime temperature, which averaged 70.5°F. The percentage of households reporting that they turned off their lights or used major appliances less in order to save energy increased significantly following the Christmas holidays.

Reduction in car use was also measured as a conservation behavior. The percentage of car owners who reported cutting down their driving increased significantly following the Christmas holidays. In addition, respondents specified the kinds of driving that were reduced. Both driving for shopping and driving on social or recreational trips decreased after Christmas. Such rates imply a drop in the volume of retail buying and leisure spending, perhaps earlier than forecast. Also, low and stable rates of cuts in chauffeur driving and driving to work are consistent with the belief that these trips are more resistant to modal shifts. The trip-to-work statistics given in Fig. 5 clearly show the absence of shifts away from the single-passenger auto trip to either public transportation or car pools.

We have explored the relations between reported conservation and a number of other variables in an attempt to predict conservation. We are unable to establish statistically significant relations between temperature reduction or the reduction in use of major appliances with any other nondemographic variables. However, reports of difficulty obtaining electricity over the past year and opinions about the importance of the current energy shortage significantly predict reports of shutting off lights. These relations are stable from November through February.

Cutting down on driving shows complex, statistically significant dependencies. First, the rate of cutting down on driving was higher for those not experiencing difficulty obtaining gas in November and December. However, during January and February, the rate of cutting down on driving was higher for those who did have difficulty getting gas. In January and February, respondents not experiencing difficulty in obtaining gas differed in their reports of reduced driving, depending on their expectations—those expecting difficulty obtaining gas next year were 1.5 times more likely to report reduced driving than those who did not expect difficulty (75 versus 53 percent). There was no difference in rates of reduced driving between those expecting and those not expecting problems obtaining gasoline for respondents who did experience difficulty getting gas. Also, respondents who thought that the energy shortage was an important national problem were 1.25 times more likely to reduce their driving than those who did not think so if they had experienced difficulty obtaining gas, but only 1.17 times more likely if they had not experienced difficulty obtaining gas. These relations imply a base level of cutting down on driving at 41 percent; this increases to 82 percent if respondents experience difficulty obtaining gasoline, expect such problems to continue, and evaluate the shortage as important.

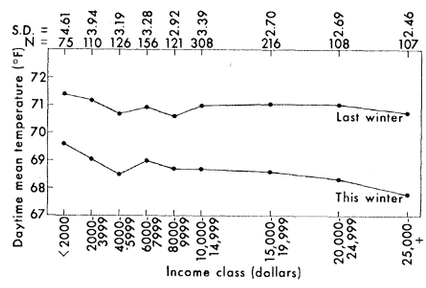


Fig. 6. Daytime mean temperature by income class (cumulative results for the interviewing period). (To convert to °C, subtract 32 and divide the difference by 1.8.)

Household income and conservation. The percentage of eligible respondents who reported a lower daytime temperature this winter than last winter is plotted against household income in Fig. 1. Note that the proportion reporting such a reduction in temperature varies positively with income. Furthermore, the mean reported daytime temperature for this winter, though not that for last winter, varies negatively with income (Fig. 6). In addition, Fig. 1 shows the percentage of car-owning households in each income class that reported a reduction in driving, one of the more important gasoline conservation measures.

The percentage of households in each income class reporting attempts to cut electricity use is also shown in Fig. 1. While we have no estimate of the amount of the reduction in electricity used per household in each class, some clues may be provided by an investigation of the distribution of various appliances over income classes. Certain appliances (such as refrigerators) use electrical power at a fairly constant rate, whereas for others (such as televisions) there may be much greater variability in electrical input over time. Households possessing stocks of appliances more heavily weighted toward the latter type are more likely, *ceteris paribus*, to effect larger short-run reductions (both proportionally and absolutely) in electricity use. Since ownership of many such appliances varies positively with income, one might expect higher-income households to show larger reductions in electricity use. However, income-related differences in reaction to price change may mitigate, if not completely negate, the effect of differences in the composition of the

stock of appliances. For example, the percentage of washer or dryer owners who reported reduced use of the appliance varies negatively with income over a range of income classes. We do not know whether, underlying this result, there is a more general tendency for higher-income households to cut use of some, but very few, of a vast array of appliances (and so to generally report trying to cut electricity use). Such a tendency might indicate that when reduction does occur, the size of the reduction in electricity use by individual upper-income households is also less for any given appliance and, potentially, for all appliances taken together.

Table 2. Households (owners and renters) reducing daytime temperature for each type of fuel used for home heating. These are cumulative results for 23 November 1973 to 28 February 1974.

Heating fuel	CNS sample		1970 census		Households reducing temperature (%)
	N	Percentage using fuel	*N*	Percentage using fuel	
Natural gas	869	56	35,013,745	55	58
Propane (liquid)	93	6	3,806,948	6	58
Fuel oil	392	25	16,473,470	26	75
Coal	18	1	1,820,952	3	33
Electricity	163	11	4,876,038	8	53
Other	13	1	1,060,194	2	31

Appendix: CNS Sample Design

The selection of households and individuals for the CNS is based on the NORC Master Probability Sample of Households—a multistage, stratified, full-probability sample of all persons, 18 years of age and older, living in households within the 48 contiguous United States. In the first stage of sampling (which took place in 1972), 101 Primary Sampling Units (counties or groups of counties) were selected. Within each of these selected PSU's, two additional stages of sampling were employed to select six ultimate segments (portions of enumeration districts or block groups).

Within each ultimate segment, a listing of all dwelling units (DU's) was made by the NORC field staff. Specific sample addresses were selected by appropriately sampling from these ultimate segment listings. (Interviews must go to selected sample addresses, no replacement is allowed.) To insure against "frame bias" arising from DU's that were missed at the time of listing, or have come into existence since that time, we employ a half-open interval technique which uniquely links each unlisted DU to a DU for which there is a listing. Within each selected DU, a single respondent is selected with equal probability from a listing of all eligible respondents.

Each week, interviewing is conducted in approximately one-quarter of the 606 ultimate segments. The allocation of these segments is done in such a way that (i) each segment falls into the sample every fourth week; (ii) each week, interviews are conducted in either one or two ultimate segments of each PSU; and (iii) within any consecutive 2-week period, exactly three segments from each of the 101 PSU's will be in the sample.

The allocation of segments to weeks has been accomplished by procedures which permit a sample from a single week to be treated as an individual probability sample of all U.S. households. In addition, the sum of any number of weekly samples (say, from week t to week $t + k$) may be viewed as a proper probability sample of all U.S. households.

Each weekly sample of households constitutes an essentially self-weighting (equal probability) sample of all U.S. households. Since the probability of selection for individuals within households depends on the total number of eligible individuals within the household, when the unit of analysis is the individual, the sample must be weighted to yield unbiased estimators.

Sampling errors. We make use of the concept of design effect in order to discuss the sampling errors of estimates derived from the CNS. Design effect (DEFT) is the ratio of the actual sampling variability of the sample-derived estimate to the sampling variability that would have resulted if the sample design had been simple random element sampling. In the case of differences between means or proportions, design effect is the ratio of actual variance (including covariance between estimates) to the variance assuming two independent simple random element samples. Although DEFT may take a different value for each individual estimate, a great deal of empirical research has shown that this ratio tends to be very similar for substantively and statistically similar estimators based on a particular design.

We have estimated DEFT's for single proportions [single week DEFT $(p_w) = 1.17$; four successive weeks DEFT $(p_m) = 1.24$] as well as for differences between proportions for successive single weeks and 4-week periods [differences between successive weeks DEFT $(p_{w1} - p_{w2}) = 1.11$; differences between successive 4-week periods DEFT $(p_{m1} - p_{m2}) = 1.10$]. (The letters are m, 4-week statistic; w, single-week statistic; and p, any proportion. An estimate of the sampling error (S.E.) of a proportion for a single week based on a sample size n_w is given by

$$\text{S.E.}\,(p_w) = \{\text{DEFT}(p_w) \times [p_w \times (1 - p_w)/n_w]\}^{\frac{1}{2}}$$

The estimate of sampling error for the difference between proportions for successive weeks is given by

$$\text{S.E.}\,(p_{w1} - p_{w2}) = \{\text{DEFT}(p_{w1} - p_{w2}) \times [(p_{w1} \times (1 - p_{w1})/n_{w1}) + (p_{w2} \times (1 - p_{w2})/n_{w2})]\}^{\frac{1}{2}}$$

Estimates of sampling error for proportions for single and successive 4-week periods are given by the formulas above, substituting the subscript m for w.

Although DEFT is influenced by all of the departures of the sample design and estimation procedures from self-weighting simple random sampling (that is, stratification, clustering, weighting, and so forth), we have found that the major influence on DEFT's (for single proportions) in the CNS design seems to be effective ultimate cluster size. Numerous computations have confirmed our expectations that most of the gasoline-related attitudes and experiences show rather high intraclass (cluster) correlations. Fortunately, effective ultimate cluster size is close to unity for both single weeks and successive periods of 4 weeks. Since interviewing is administered in the same ultimate cluster every 4 weeks, the design effect for differences between monthly periods is appreciably lower than the design effect for a single 4-week period.

Notes

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