WHY ARE ENERGY POLICIES ACCEPTABLE AND EFFECTIVE?

LINDA STEG *is a lecturer in environmental psychology at the University of Groningen, the Netherlands. She is particularly interested in studying individual and corporate behavior related to sustainable development from a multidisciplinary perspective. Her research projects focus on understanding and changing environmentally significant behavior, such as energy and car use.*

LIEKE DREIJERINK *obtained her master's in social psychology at the University of Groningen, the Netherlands, in 2003. Her master's thesis focused on factors influencing the acceptability and perceived effectiveness of energy-saving policies. The present article is based on this master's thesis.*

WOKJE ABRAHAMSE *is a Ph.D. student at the University of Groningen. Her research topic focuses on household energy conservation.*

ABSTRACT: This article examines which policy features affect the perceived effectiveness and acceptability of pricing policies aimed to reduce CO_2 emissions. A survey study was conducted among 112 Dutch respondents in 2003. As hypothesized, incentives and policies targeting efficiency behavior were perceived to be more effective and acceptable than were disincentives and policies targeting curtailment behavior. Policies targeting direct energy use were evaluated as more effective than those targeting indirect energy use. No significant differences were found between the acceptability of policies targeting direct and indirect energy savings. As expected, push measures were perceived to be more effective and acceptable when revenues are allocated within the energy domain rather than to general funds. Pull measures were evaluated as more effective when they are funded from within the energy domain rather than from general public funds. The way pull measures are funded did not significantly affect their acceptability.

Keywords: *energy policy; acceptability; effectiveness; policy features; revenue use; energy use*

The greenhouse effect has been a main issue in international debates for quite some time now. Various actions have been undertaken to reduce emissions

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of greenhouse gases. On one hand, technological measures have been proposed aimed at reducing environmental impact per unit, for example, making products and services more energy efficient. On the other hand, it is acknowledged that (especially energy-intensive) products and services need to be used less intensively. Despite international agreements, such as the Kyoto Protocol, greenhouse gas emissions are still increasing. Since 1990, greenhouse gas emissions have risen by about 1% per year (e.g., Environmental Protection Agency [EPA], 2004; Rijksinstituut voor Volksgezondheid en Milieu [RIVM], 2004). The most important greenhouse gas is CO_2, constituting about 84% of total greenhouse gas emissions (EPA, 2004). In 2001, more than 95% of CO_2 emissions were caused by the combustion of fossil fuels (EPA, 2004).

Households are an important target group when trying to reduce greenhouse gas emissions. Household energy use significantly contributes to greenhouse gas emissions. For instance, in the United States, households use about 32% of total energy use (Gardner & Stern, 2002), and in the Netherlands, households are responsible for 23% of total energy use (Dutch Ministry of Economic Affairs, 1999), by using electricity, natural gas, and fuels. Apart from the use of electricity, natural gas, and fuels (i.e., direct energy use), households also use energy in an indirect way (e.g., Vringer & Blok, 1995). Indirect energy use refers to the amount of energy that is used for the production, transportation, and disposal of goods and services. A system inventory and analysis revealed that in the Netherlands, about 45% of total energy use by households involves direct energy use, whereas 55% involves indirect energy use (Noorman & Schoot Uiterkamp, 1998; Vringer & Blok, 1995).

Despite various policy efforts, household energy consumption is still increasing. For example, in the Netherlands, electricity and fuel use has increased steadily from 1990 because of an increase in possession and use of electric appliances and in car use (Noorman & Schoot Uiterkamp, 1998; L. Steg, 1999). There has been much discussion about which policies may be effective and feasible in reducing household energy use and, consequently, CO_2 emissions. An important precondition for the successful implementation of energy policies is public acceptability. Without public support, energy policies can hardly be implemented because of public resistance and reluctance among politicians to implement policies lacking public support.

Two factors may influence public acceptability of policy measures aimed to reduce energy use: individual factors and characteristics of the policy to be implemented. First, public acceptability is dependent on individual factors, such as individual attitudes and preferences. Many (psychological) studies have tried to identify individual factors that affect public acceptability, for example, regarding transport pricing (e.g., Arkensteijn & Oerlemans, 2005; Jakobsson, Fujii, & Gärling, 2000; Loukopoulos, Jakobsson, Gärling, Schneider, & Fujii, 2005; Schade & Schlag, 2000, 2003; Schlag & Teubel, 1997; Schuitema, 2003; Stern, Dietz, & Kalof, 1993) and energy use (L. Steg, Dreijerink, & Abrahamse, 2005). Among other things, these studies revealed that policies are judged to be more acceptable when people are more aware of the environmental problems at stake, when they feel more responsible for these problems, and when they feel a stronger moral obligation to contribute to the solution of these problems. In addition, policies are evaluated as less acceptable when they are perceived to be unfair, when they seriously threaten people's freedom of choice, and when people believe the policies will not be effective in reducing environmental problems at stake.

The relationship between acceptability and perceived effectiveness of energy policies is not straightforward. Studies on transport policies reveal that, in general, people evaluate policies as more acceptable when they believe these policies indeed reduce environmental problems (Schade & Schlag, 2003; E. M. Steg, 1996). It is not surprising that policies resulting in negative consequences for individuals without even being effective in reducing environmental problems will not gain much public acceptance. All the same, policies are not very acceptable when they seriously restrict people's freedom of choice and force people to change their own behavior (e.g., Bamberg & Rölle, 2003; Jakobsson et al., 2000). So people seem to especially accept policies that reduce environmental problems, preferably without significantly affecting their own behavior. Because perceived effectiveness of policies is related to policy acceptability, it is important to study perceived effectiveness and acceptability. Perceived effectiveness is not necessarily related to actual effectiveness of policies. People can easily be wrong on what actually would be effective, given the fact that in many cases, they do not have any experience with such policies and, consequently, do not know the possible environmental impact of such policies.

Second, features of energy policies may influence their acceptability. A study by Poortinga, Steg, Vlek, and Wiersma (2003) revealed that the acceptability of specific energy-saving measures to be adopted by households, such as applying radiator insulation or reducing showering time, was dependent on characteristics of these measures. In general, consumers preferred energy-saving measures at home above transport energy-saving measures. Furthermore, they found technical measures (e.g., buying an energy-efficient heating system, applying insulation) more acceptable than behavioral changes (e.g., walking or cycling short distances instead of driving, line drying of laundry instead of using a tumble dryer) and especially compared to shifts in consumption aimed at reducing indirect energy use (e.g., not buying greenhouse vegetables, not buying energy-intensive presents, e.g., rather buy CDs than greenhouse flowers as a gift). This study did not examine whether policy features affect the perceived effectiveness of these energy conservation measures. In fact, still relatively little is known about the extent to which perceived effectiveness and acceptability of energy policies is dependent on policy characteristics, that is, the way a specific policy is designed.

This article aims to examine to what extent features of energy policies affect the perceived effectiveness and acceptability of these policies.[1] As a case in point, we focus on pricing policies aimed at reducing CO_2 emissions by households. In the next section, four relevant policy features are discussed. Next, the results of a survey study aimed at examining the extent to which different policy features affect the perceived effectiveness and acceptability of pricing policies are reported and discussed.

POLICY FEATURES INFLUENCING PERCEIVED EFFECTIVENESS AND ACCEPTABILITY OF ENERGY POLICIES

Pricing policies aimed to reduce CO_2 emissions by households can be designed in different ways. Here, we focus on policies that differ with respect to the following four features: (a) the way they influence behavior (use of incentives vs. disincentives), (b) the target behavior of the policy (technology vs. behavioral changes), (c) the type of energy use being addressed (direct vs. indirect energy use), and (d) the way incentives are financed or revenues from disincentives are allocated (inside the domain vs. general public funds). Each of these policy features is explained in more detail below.

A first important feature of energy policies is whether incentives (rewards) or disincentives (penalties) are used to change behavior (e.g., Cook & Berrenberg, 1981; De Young, 1996; Geller, 2002). Pricing policies may be aimed to decrease the prices of products and services related to lower CO_2 emissions (so-called pull measures) and/or increase the prices of products and services associated with higher CO_2 emissions (so-called push measures). The distinction between pull and push measures is highly relevant when examining the acceptability of policies. Push measures may be perceived as coercive, by making environmentally unsound behavior more expensive and, consequently, less attractive. In contrast, pull measures are aimed at making environmentally friendly behavior less expensive, are noncoercive in nature, and consequently, more attractive. Not surprisingly, studies in the transport field revealed that people generally evaluate pull measures as more acceptable than push measures (e.g., Schade, 2003; L. Steg, 2003; L. Steg & Vlek, 1997). Pull measures may be less effective than push measures because the former are noncommittal in nature, whereas the latter may actually force people to change behavior. However, some scholars have argued that push measures may be less effective than pull measures because push measures are typically accompanied by negative affect, feelings, or attitudes toward the behavior change because they are more likely to threaten individual freedom (e.g., Geller, 2002). According to Geller (2002), positive attitudes are more likely to follow pull measures because such an approach is more likely to be perceived as so-called voluntary. Moreover, he argued that when a positive attitude is linked to one's change in behavior, the probability that the desired behavior will become a social norm increases. In contrast, Geller argued, push measures are less likely to result in changes in attitudes and norms that are in line with and strengthen the behavior change. Such behavior changes are generally less stable. Evidence from the transport field suggests that pull measures, such as reducing prices of public transport, are generally not very effective in reducing car use (e.g., Claassen & Kropman, 1995; Deslauriers & Everett, 1977). In contrast, push measures, that is, increasing prices of car use, appeared to be effective in reducing car use (e.g., Gomez-Ibanez & Small, 1994; see Verhoef et al., 2004, for a review). In contrast, empirical studies on perceived effectiveness of policies in the transport field support the second line of reasoning, that is, it appeared that people evaluate pull measures as more effective than push measures, and people have more favorable attitudes toward pull measures compared to push measures (e.g., L. Steg & Vlek, 1997; Stradling, Meadows, & Beatty, 1999). This suggests that people may indeed be wrong in what actually would be effective. People may give strategic answers, insofar as they believe that push measures may not be implemented if they can convince policy makers that these measures will not be effective.

Second, policies can target different types of energy-saving behavior. This may result in different acceptability judgments, especially when these behaviors have different psychological properties. The distinction between so-called efficiency and curtailment behavior is relevant in this respect (Gardner & Stern, 2002). Policies targeting efficiency behavior are aimed to encourage the adoption of energy-efficient equipment, such as buying an energy-efficient car or freezer. Efficiency behavior is typically performed infrequently or only once and does not require continuous attention or effort. Such actions permit people to maintain existing lifestyles while reducing energy use. Consequently, they do generally not interfere with people's quality of life. In contrast, curtailment behavior involves changing the use of existing energy equipment, products, and services. Curtailment actions typically involve small, simple behaviors that must be repeated again for long time periods, for example, reducing showering time or lowering thermostat settings. They require people to make continuous efforts to monitor and change behavior, at least for some time, until new (energy-saving) habits are formed. In many cases, curtailment actions decrease comfort and quality of life, and consequently, such changes may be perceived as undesirable. As described earlier, a study by Poortinga and colleagues (2003) indeed revealed that consumers evaluate the adoption of efficiency behavior as more acceptable than the adoption of curtailment actions. Generally, efficiency actions are also considered to be more effective in reducing energy consumption than are curtailment actions. This is in line with expert judgments that argue that efficiency actions are more effective because they are associated with higher energy savings and do not require continuous monitoring (Gardner & Stern, 2002). Because of the different psychological properties of efficiency and curtailment behavior, we hypothesized that policies targeting curtailment behavior are evaluated as less effective and less acceptable compared to those targeting efficiency behavior.

Third, policies may aim to reduce direct or indirect energy use of households. People are more familiar with ways to reduce direct energy use. Moreover, they can more easily monitor the effects of their efforts to reduce direct energy use, by reading their gas, electricity, and fuel meters. In contrast, people tend to know little about indirect energy use, that is, they are not familiar with the amount of energy involved to produce, distribute, and dispose of goods and services they consume. Moreover, they are less familiar with ways to reduce indirect energy use, for instance by consuming less energy-intensive products (e.g., buying seasonal rather than greenhouse vegetables), or by shifting expenditures to goods with a lower energy intensity (e.g., buying a CD rather than flowers as a present; cf. Poortinga et al., 2003). People may be more reluctant to accept policies aimed at reducing indirect energy use because they are less sure about the extent to which such actions are effective in reducing energy use, and consequently, CO_2 emissions.

Fourth, revenue allocation appears to affect the acceptability of pricing policies, that is, push measures (price increases) are more acceptable when revenues are spent in a way that benefit the person directly (e.g., Harrington, Krupnick, & Alberini, 2001; Jones, 1991; Lyons, Dudley, Slater, & Parkhurst, 2004; Verhoef, 1996) or within the same domain (Lyons et al., 2004), whereas they more strongly oppose the same measures when revenues are allocated to general public funds. We hypothesized that people also think energy policies are more effective if revenues are spent within the same domain because in that case additional funds are available to further reduce

CO_2 emissions. Little is known about whether the perceived effectiveness and acceptability of pull measures is dependent on the way these measures are funded. It may be hypothesized that people prefer pull measures being financed from within the same (viz., energy-related) domain rather than from general public funds, as far as additional efforts are being made to further reduce CO_2 emissions. For example, funds may be gathered within the energy domain by increasing prices of energy-intensive products and services. For this reason, pull measures may also be perceived to be more effective if they are financed by means of funds related to the energy domain as compared to general public funds.

In sum, the following hypotheses were tested in the current study:

Hypothesis 1: Pull measures are perceived to be more effective and acceptable than push measures.

Hypothesis 2: Policies targeting efficiency behavior are believed to be more effective and acceptable than those targeting curtailment behavior.

Hypothesis 3: Policies aimed at direct energy conservation are considered to be more effective and acceptable than policies aimed at reducing indirect energy use.

Hypothesis 4: Push measures are believed to be more effective and acceptable if revenues are allocated within the same domain rather than to general public funds. Pull measures are considered to be more effective and acceptable if they are financed from within the energy domain rather than from general public funds.

METHOD

RESPONDENTS AND PROCEDURE

In 2003, 300 surveys, together with reply-paid envelopes, were distributed at different locations and times in Groningen, a city in the north of the Netherlands. In total, 118 surveys were returned (a response rate of 39%). Because 6 surveys were not fully completed, 112 surveys were used in the analysis. Participants were 52 male and 58 female respondents, ranging in age from 19 to 81 years, with a mean age of 39.8 years ($SD = 16.35$). In total, 33% of participants indicated that their net salary per month was “less than 1200 Euro,” 32% “between 1200 and 2500 Euro,” and 34% “more than 2500 Euro,” for one respondent these data were missing (1 Euro = US$1.27 = £.71). The distribution of highest educational level attained showed 15% had completed primary, technical, or vocational secondary school education, 39% had completed the highest level of secondary education, and 46% had attained a college or university degree or equivalent.[2]

The questionnaire consisted of five parts. Only the second part, in which respondents evaluated the effectiveness and acceptability of energy policies aimed at reducing CO_2 emissions, is of relevance to this article. The other parts focused on demographics (reported above) and on individual factors that may affect acceptability judgments (reported elsewhere).

Acceptability and perceived effectiveness of energy policies. Respondents evaluated 16 pricing policies aimed to reduce the emission of CO_2 by households on a 5-point scale, ranging from 1 (*not acceptable at all*) to 5 (*very acceptable*). These policies systematically varied on the four dimensions discussed above: push versus pull policies, policies targeting efficiency versus curtailment behavior, policies aimed at reducing direct versus indirect energy use, and revenue use or fund gathering within the domain (e.g., energy related) versus from general funds. Table 1 gives an overview of the 16 pricing policies. The policies were presented in random order. Respondents also indicated to what extent they believed the policies would reduce problems caused by energy use. Again, answers were given on a 5-point scale, ranging from 1 (*the problems will not decrease at all*) to 5 (*the problems will strongly decrease*).

ANALYSES

Two conjoint analyses were conducted to examine to what extent the four features of energy policies contribute to the explanation of perceived effectiveness and acceptability of these policies, respectively. Conjoint analysis is a decompositional method that estimates the structure of individual preferences in an indirect way (Green & Srinivasan, 1978; Louvriere, 1988; Luce & Tukey, 1964; Wierenga & Van Raaij, 1987). The basic idea of conjoint analysis is that preferences for a particular stimulus (in the current study: the perceived effectiveness and acceptability of energy policies) are built up by the independent contributions of different attributes (in this case: policy features), each with a limited number of levels (in the current study each policy feature had two levels) that are systematically varied in the stimuli provided to respondents. An additive part-worth function model was used, which means that the perceived effectiveness and acceptability of energy policies was taken to be the sum of contributions of the four policy features (viz., attributes). A detailed description of conjoint analysis can be found in Green and Srinivasan (1978) and Louvriere (1988).

TABLE 1
Overview of 16 Pricing Policies Aimed to Reduce CO_2 Emissions by Households

	Push or Pull	*Efficiency or Curtailment*	*Direct or Indirect*	*Revenue Use Within or Outside Domain*	M_{accept}	M_{effect}
Increase prices of appliances that are not energy efficient by 10%. Revenues are used to stimulate the development of energy-efficient appliances.	Push	Efficiency	Direct	Within	3.88	3.32
Increase prices of appliances that are not energy efficient by 10%. Revenues are used to reduce national debts.	Push	Efficiency	Direct	Outside	3.04	3.00
Increase prices of appliances that have not been produced in an energy-efficient way by 10%. Revenues are used to develop techniques that reduce energy use for the production of appliances.	Push	Efficiency	Indirect	Within	3.93	3.48
Increase prices of appliances that have not been produced in an energy-efficient way by 10%. Revenues are used to reduce national debts.	Push	Efficiency	Indirect	Outside	2.69	2.76
Increase prices of regular electricity by 10%. Revenues are used to generate more green electricity, for example, by building windmills.	Push	Curtailment	Direct	Within	3.75	3.62
Increase prices of regular electricity by 10%. Revenues are used to reduce national debts.	Push	Curtailment	Direct	Outside	2.71	2.74
Increase prices of imported and greenhouse vegetables and fruit by 10%. Revenues are used to stimulate farmers and market gardeners to grow seasonal vegetables.	Push	Curtailment	Indirect	Within	3.52	3.19

Increase prices of imported and greenhouse vegetables and fruit by 10%. Revenues are used to reduce national debts.	Push	Curtailment	Indirect	Outside	2.71	2.71
Subsidize energy-efficient appliances so as to make them 10% cheaper. Subsidies are funded from energy taxes charged on appliances that are not energy efficient.	Pull	Efficiency	Direct	Within	3.92	3.68
Subsidize energy-efficient appliances to make them 10% cheaper. Subsidies are paid from general public funds.	Pull	Efficiency	Direct	Outside	3.55	3.39
Subsidize appliances that are produced in an energy-efficient way to make them 10% cheaper. Subsidies are funded from energy taxes charged on appliances that are not energy efficient.	Pull	Efficiency	Indirect	Within	3.93	3.59
Subsidize appliances that are produced in an energy-efficient way to make them 10% cheaper. Subsidies are paid from general public funds.	Pull	Efficiency	Indirect	Outside	3.82	3.38
Decrease prices of green electricity by 10%. Subsidies are paid from an ecotax charged on regular energy.	Pull	Curtailment	Direct	Within	3.80	3.55
Decrease prices of green electricity by 10%. Subsidies are paid from general public funds.	Pull	Curtailment	Direct	Outside	3.69	3.37
Reduce prices of local seasonal vegetables and fruit (not raised in greenhouses) by 10%. Subsidies are paid from extra taxes on imported and hothouse vegetables and fruit.	Pull	Curtailment	Indirect	Inside	3.51	3.23
Reduce prices of local seasonal vegetables and fruit (not grown in greenhouses) by 10%. Subsidies are paid from general public funds.	Pull	Curtailment	Indirect	Outside	3.29	3.13

NOTE: M_{effect} = mean score on perceived effectiveness, M_{accept} = mean score on acceptability of the specific pricing policy.

A full factorial design was used, that is, all combinations of policy features were evaluated, which yields a total of 16 stimulus combinations (see Table 1). We explain the main characteristics and outcomes below. By systematically varying the combination of the four policy features, the contribution of each attribute level (in this case: level of each policy feature) to overall perceived effectiveness and acceptability of energy policies can be estimated for each respondent separately; these are called part-worth scores. The average part-worth score reveals to what extent each level of a policy feature contributes to overall perceived effectiveness and acceptability of energy policies, respectively. A negative part-worth score indicates that policies having this feature are perceived to be less effective or acceptable, and a positive part-worth score indicates that policies having this feature are perceived to be more effective or acceptable. To assess the relative importance of a policy characteristic in explaining perceived effectiveness and acceptability, first, for each respondent, the range of part-worth scores (i.e., the difference between the highest and lowest part-worth score) is computed. Next, the mean range of part-worth scores (across respondents) of a policy feature is computed; the higher the range (i.e., the higher the variance in part-worth scores), the more important an attribute is for explaining overall effectiveness and acceptability, respectively. The relative importance of a characteristic (compared to other characteristics) is assessed by comparing its range of part-worth scores to the total range of part-worth scores; this is labeled as *average importance*. A low-average importance implies that the policy characteristic does not result in much variance in judgments, and a high-average importance implies that the specific policy characteristic does result in much variance in judgments. In the Results section, we report the average part-worth score and the average importance of each policy characteristic.

Unfortunately, conjoint analysis does not reveal whether the contribution of the different policy features to overall perceived effectiveness and acceptability of energy policies is statistically significant. Therefore, paired *t* tests were conducted to test whether differences in mean scores of the effectiveness and acceptability of the different types of energy policies were statistically significant. For this purpose, mean scores were computed for each type of policy (e.g., mean acceptability of push measures, mean acceptability of pull measures, etc.); these are also reported in the Results section. Moreover, the population value of the difference between each two means is reported (95% confidence interval [CI]). In line with the hypotheses, we tested three main effects (i.e., push vs. pull, efficiency vs. curtailment, direct vs. indirect energy use) and one interaction effect (i.e., revenue use of push measures within vs. outside the energy-related domain and fund gathering to finance pull measures within vs. outside the energy-related domain). To reduce the influence of capitalization on chance, for all t tests, a Bonferroni correction was applied, that is, only differences with a p value smaller than .01 were assumed to be statistically significant.

RESULTS

Results of the conjoint analysis on the effectiveness judgments are given in Table 2. It appeared that the model fit was reasonably good (Pearson's r = .69, p = .0017; Kendall's tau = .47; p = .0057).[3] Perceived effectiveness of energy policies was most strongly affected by whether prices of products and services related to high CO_2 emissions increase or prices of products and services related to low CO_2 emissions decrease (average importance = 27.54). Part-worth scores[4] and mean scores revealed that pull measures were believed to be more effective (M = 3.42)[5] than were push measures (M = 3.11): $t(108) = -6.86$, $p < .001$; the population value of the difference in perceived effectiveness of pull and push measures (95% CI) is rated to be between .22 and .40; this CI is rather narrow and does not include 0, which implies that the difference is significant by conventional standards (Smithson, 2003).

Second, as hypothesized, efficiency policies (M = 3.33) were evaluated as more effective than were curtailment policies (M = 3.20): $t(108) = 3.01$, p = .003; 95% CI of the difference in perceived effectiveness of efficiency and curtailment policies: .05 and .22. In addition, in line with our hypotheses, policies targeting direct energy use were perceived to be more effective (M = 3.34) than those targeting indirect energy use (M = 3.19); $t(108) = 3.82$, p < .001; 95% CI of the difference in perceived effectiveness of policies targeting direct and indirect policies: .07, .23. Moreover, as expected, respondents perceived push measures to be more effective if revenues are allocated within the domain to further reduce CO_2 emissions (M = 3.40) as compared to using the revenues to reduce national debts (M = 2.80); t =7.72, p < .001: the 95% CI of the difference between perceived effectiveness of push measures when revenues are spent within versus outside the domain is rated to be between .44 and .75. Finally, as hypothesized, pull measures were believed to be more effective if these measures are funded from within the energy domain (M = 3.51) compared to financing the price reductions from general public funds (M = 3.32): t = 3.09, p = .003; 95% CI of the difference of perceived effectiveness of pull measures financed from within versus outside the domain is rated to be between .07 and .32.

Table 3 gives the results of the conjoint analysis on the acceptability judgments. Again, it appeared that the model had a reasonably good fit (Pearson's

TABLE 2
Average Part-Worth Scores and Average Importance of Policy Features for Perceived Effectiveness of Energy Policies

Policy Feature and Level	*Average Part-Worth Scores*	*Average Importance*
1. Push	–.160	27.54
Pull	.160	
2. Efficiency	.070	22.52
Curtailment	–.070	
3. Direct	.079	23.97
Indirect	–.079	
4. Push - general funds	–.107	25.96
Push - within domain	.107	
Pull - general funds	.107	
Pull - within domain	–.107	
Constant	3.25	

TABLE 3
Average Part-Worth Scores and Average Importance of Policy Features for Acceptability of Energy Policies

Policy Feature and Level	*Average Part-Worth Scores*	*Average Importance*
1. Push	–.186	28.01
Pull	.186	
2. Efficiency	.134	22.34
Curtailment	–.134	
3. Direct	.047	18.44
Indirect	–.047	
4. Push - general funds	–.182	30.30
Push - within domain	.182	
Pull - general funds	.182	
Pull - within domain	–.182	
Constant	3.49	

$r = .70$, $p = .001$; Kendall's tau = .48, $p = .005$). The average importance ratings revealed that the acceptability of energy policies is strongly related to whether the policy is aimed at rewarding so-called good behavior or penalizing bad behavior. Part-worth scores and the mean scores revealed that as expected, pull measures were judged to be more acceptable ($M = 3.69$) than were push measures ($M = 3.32$): $t(110) = –6.39$, $p < .001$; 95% CI of the difference in acceptability of pull and push measures: .25, .48. Furthermore, as hypothesized, respondents evaluated efficiency policies as more acceptable (M = 3.64) compared to policies targeting curtailment behavior (M = 3.37); t = 6.55, p < .001; 95% CI of the difference in acceptability of policies targeting efficiency and curtailment behavior: .19, .35. Whether energy policies targeted direct or indirect energy use did not affect acceptability judgments much. The acceptability of policies targeting direct energy use (M = 3.55) or indirect energy use (M = 3.46) did not significantly differ because a Bonferroni correction is applied: $t(110) = 2.36$, p = .02; the 95% CI of the difference in acceptability of policies targeting direct and indirect policies almost included 0: .01, .17. The interaction effect strongly contributed to the explanation of the acceptability judgments as well. As expected, push measures were more acceptable when revenues were allocated within the energy domain (M = 3.77) than when revenues were used to reduce national debts (M = 2.85); t = 12.12, p < .001; the 95% CI of the difference between acceptability of push measures when revenues are spent within versus outside the domain is rated to be between .77 and 1.06. The way pull measures are funded did not affect acceptability of energy policies much (M = 3.79 if funded from within energy domain and M = 3.59 if paid from public funds; t = 2.34, p = .02). This difference is not statistically significant because a Bonferroni correction is applied; the 95% CI of the difference between acceptability of pull measures when revenues are spent within versus outside the domain is rated to be between .03 and .37. From the above, we may conclude that the acceptability of push measures did not differ much from the acceptability of pull measures, provided that revenues are allocated to stimulate further CO_2 emission reductions.

The results reported above suggest that the acceptability and perceived effectiveness judgments may be correlated. Indeed, the evaluation of the perceived effectiveness and acceptability of the different types of energy policies appeared to be correlated quite strongly; Pearson's r varied between .56 and .67. Respondents evaluated energy policies as more acceptable to the extent that they believe these policies will be effective in reducing CO_2 emissions.

DISCUSSION

The current study revealed that the extent to which people think energy policies are effective and acceptable is indeed dependent on features of these policies. As expected, respondents preferred the so-called carrot above the stick, that is, they perceived pull measures to be more effective and acceptable than push measures. These results are in line with earlier studies in the transport field (Schade, 2003; L. Steg, 2003; L. Steg & Vlek, 1997; Stradling et al., 1999). Whether incentives or disincentives are used is one of the most important policy features that influences perceived effectiveness and acceptability of energy policies. Not surprisingly, support for noncoercive pull measures is stronger than for push measures that are more coercive. Interestingly, respondents also perceive pull measures to be more effective compared to push measures. This seems to be in contradiction with practical evidence in the transport field, which revealed that increasing prices of car use (i.e., a push measure) is generally more effective than decreasing prices of public transport (i.e., a pull measure; see the introductory section of this article). This implies that people's perception may not be accurate. They may give strategic answers (see introductory section of this article). Furthermore, it may be that people are in principle willing to act environmentally friendly and consequently reduce CO_2 emissions provided that such behavior is not associated with higher financial costs, as is common nowadays. Of course, the perceived and actual effectiveness will depend on the relative size of the push and pull measures being studied. Further research is needed to examine the relationships between acceptability, perceived effectiveness, and actual effectiveness of pricing policies aimed at reducing energy consumption. Psychological studies aimed at evaluating the actual effects of energy-saving strategies tend to focus on psychological strategies targeting individual perceptions, preferences, beliefs, and attitudes, such as information campaigns, feedback, commitment, and goal setting, and not on the effects of structural strategies aimed to change the context in which decisions are made, such as pricing and legal measures (e.g., Abrahamse, Steg, Vlek, & Rothengatter, 2005; Cook & Berrenberg, 1981; Dwyer, Leeming, Cobern, Porter, & Jackson, 1993).

Allocation of revenues from push measures was also strongly related to perceived effectiveness and acceptability of these energy policies. Push measures were perceived to be more effective and acceptable if revenues are allocated within the energy domain compared to general public funds. By allocating revenues within the same domain, additional efforts are being made to reduce CO_2 emissions, and consequently, such policies may be even more effective. The current study replicates findings of earlier studies, that is, price increases are more acceptable if revenues are spent within the energy-related domain rather than allocated to general public funds (e.g., Lyons et al., 2004; Verhoef, 1996). This suggests that findings from transport studies can be generalized to the domain of household energy use. Strikingly, it appeared that push measures are only perceived to be less acceptable than pull measures if revenues are allocated to general public funds. If revenues are spent to further reduce CO_2 emissions, push measures were as acceptable as pull measures.

Pull measures were perceived to be somewhat more effective when funded from within the energy domain rather than from general public funds. This may be because funds were gathered by increasing prices of products and services associated with relatively high CO_2 emissions. Thus, in this case, additional efforts are being made to further decrease CO_2 emissions. The way pull measures are funded did not have a significant effect on the acceptability of these measures.

As expected, policies targeting curtailment behavior were perceived to be less effective and less acceptable than those targeting efficiency behavior. Respondents seemed to agree with experts (see Gardner & Stern, 2002) that efficiency actions aimed to stimulate the adoption of energy-efficient appliances are more effective in reducing household energy use and, consequently, CO_2 emissions, than are curtailment actions. Policies stimulating efficiency behavior were also more acceptable, probably because they require less effort and hardly interfere with people's lives, and because they are believed to be effective. These results are in line with those reported by Poortinga and colleagues (2003).

Whether energy policies target direct or indirect energy use did affect the effectiveness of those policies, although this relationship was not very strong. As expected, policies targeting direct energy use were perceived to be more effective than those targeting indirect energy use. This may be because people are more familiar with direct energy use and know less about the possible effects of indirect energy savings. In contrast to our expectations, no significant differences were found between the acceptability of policies targeting direct and indirect energy savings. These results are in contradiction with those of Poortinga and colleagues (2003), who did report differences in the acceptability of direct and indirect energy savings. It may be that the current study included only behavioral actions that people do associate with energy use, whereas Poortinga and colleagues (2003) also included actions that people may not associate with energy savings at all, such as hiring a housekeeper. Hiring a housekeeper implies that household budget cannot be allocated to other, possibly more energy-intensive actions (e.g., buying a dishwasher), and may therefore contribute to overall energy savings and reductions in CO_2 emissions.

It is important to study perceived effectiveness of policies because this is related to acceptability of environmental policies. Indeed, the current study revealed that perceived effectiveness of energy policies was significantly correlated with the acceptability of those policies. Apparently, respondents are in favor of policies that indeed would reduce energy problems and enhance the quality of the environment. This is in accordance with earlier studies, in which positive correlations between perceived effectiveness and acceptability judgments were reported as well (e.g., Schade & Schlag, 2003; E. M. Steg, 1996). Again, this illustrates that findings from transport studies may be generalized to the energy domain. Of course, as explained earlier, perceived effectiveness may differ from actual effectiveness of policies. Based on the current study, we cannot draw any definite conclusion on the relationship between acceptability and actual effectiveness. This is an important topic for future studies.

The results clearly reveal that perceived effectiveness and acceptability of pricing policies are related to features of those policies. Thus, perceived effectiveness and acceptability of policies may not be enhanced only by taking into account individual factors influencing such judgments (e.g., Jakobsson et al., 2000; Schade & Schlag, 2000, 2003; L. Steg et al., 2005; Stern et al., 1993; see introductory section of this article) but also by carefully taking into account the way a policy is designed and which target behavior is being addressed. In addition, the way revenues are allocated strongly affects the perceived effectiveness and acceptability of energy policies. Public support for push measures (i.e., price increases) may be strongly enhanced if revenues are allocated within the same domain. However, future studies should examine to what extent this would affect actual effectiveness of such policies. For sure, policies should not only be acceptable but also effective in solving the problems at stake. It seems important to highlight the possible effects of environmental policies because policies are more likely to be approved by the general public when people trust the policies to be effective in solving environmental problems. In contrast, public support for policies that are perceived to be less effective is less strong.

The current study focused on pricing policies aimed to reduce CO_2 emissions by households and replicated results from previous studies on the acceptability of policies aimed to reduce problems related to traffic and transport. Future research should clarify whether these results can be generalized to other policy strategies (e.g., infrastructural measures, educational programs, legal measures), other domains (e.g., waste reduction, water use), and other target groups (e.g., industry, business organizations).

NOTES

1. The extent to which individual characteristics affect policy acceptability was examined as well. Results are discussed elsewhere (see L. Steg, Dreijerink, & Abramanse, 2005).

2. Our sampling method does not guarantee that the results may be generalized to the Dutch population. However, we were mainly interested in studying relationships between policy characteristics and perceived effectiveness and acceptability of these policies. We have no reason to believe that the current sample is not accurate for this purpose because no significant differences (at $p < .01$) were found in part-worth scores (the meaning of these scores is explained in the Analysis section) between groups differing in age, gender, educational level, household income, and household type. This implies that the contribution of each level of each policy feature to overall perceived effectiveness and acceptability did not differ among groups differing in age, gender, educational level, household income, and household type.

3. Pearson's *r* and Kendall's tau indicate the fit of the conjoint model and reflect the relationships between the observed and estimated preferences (in this case: perceived effectiveness and acceptability, respectively). Preferences are estimated as follows. First, part-worth scores are multiplied with 1 if the pricing policy has the specific characteristic, and with 0 if the pricing policy does not have the specific characteristic. Second, these product scores are added to the constant (also printed in Tables 2 and 3). For example, the acceptability of Pricing Policy Number 1 (push, efficiency, direct, within domain, see Tables 1 and 3) is estimated as follows: $3.49 + (–.186 \times 1) + (.186 \times 0) + (.134 \times 1) + (–.134 \times 0) + (.047 \times 1) + (–.047 \times 0) + (–.182 \times 0) + (.182 \times 1) + (.182 \times 0) + (–.182 \times 0) = 3.67$.

4. The part-worth scores of the attribute levels are perfectly correlated, since the four attributes each had two levels.

5. Mean scores can be assessed by adding the constant and the part-worth score of the attribute levels; because rounding off these numbers may slightly differ.

REFERENCES

Abrahamse, W., Steg, L., Vlek, C., & Rothengatter, J. A. (2005). A review of intervention studies focusing on household energy conservation. Manuscript submitted for publication.

Arkensteijn, K., & Oerlemans, L. (2005). The early adoption of green power by Dutch households: An empirical exploration of factors influencing the early adoption of green electricity for domestic purposes. *Energy Policy*, *33*(2), 183-196.

Bamberg, S., & Rölle, D. (2003). Determinants of people's acceptability of pricing measures—Replication and extension of a causal model. In J. Schade & B. Schlag (Eds.), *Acceptability of transport pricing strategies* (pp. 235-248). Oxford, UK: Elsevier Science.

Claassen, A., & Kropman, J. (1995). *Verkenningen tussen theorie en praktijk: Over de bijdrage van de sociale wetenschappen aan de beleidspraktijk op het gebied van mobiliteit* [Between theory and practice: Contribution of social scientist to traffic and transport policy]. Nijmegen, the Netherlands: Instituut voor Toegepaste Sociale Wetenschappen.

Cook, S. W., & Berrenberg, J. L. (1981). Approaches to encouraging conservation behavior: A review and conceptual framework. *Journal of Social Issues*, *37*(2), 73-107.

Deslauriers, B. C., & Everett, P. B. (1977). Effects of intermittent and continuous token reinforcement on bus ridership. *Journal of Applied Psychology*, *62*(4), 369-375.

De Young, R. (1996). Some psychological aspects of reduced consumption behavior: The role of intrinsic satisfaction and competence motivation. *Environment and Behavior*, *28*(3), 358-409.

Dutch Ministry of Economic Affairs. (1999). *Actieprogramma energie besparing 1999-2002* [Action program energy conservation 1999-2002]. Den Haag, the Netherlands: Ministerie van Economische Zaken.

Dwyer, W. O., Leeming, F. C., Cobern, M. K., Porter, B. E., & Jackson, J. M. (1993). Critical review of behavioral interventions to preserve the environment: Research since 1980. *Environment and Behavior*, *25*(3), 275-321.

Environmental Protection Agency. (2004). *Inventory of U.S. greenhouse gas emissions and sinks, 1990-2002* (EPA 430-R-04-003). Washington, DC: Author.

Gardner, G. T., & Stern, P. C. (2002). *Environmental problems and human behavior* (2nd ed.). Boston: Pearson Custom.

Geller, E. S. (2002). The challenge of increasing proenvironmental behavior. In R. B. Bechtel & A. Churchman (Eds.), *Handbook of environmental psychology* (pp. 541-553). New York: John Wiley.

Gomez-Ibanez, J. A., & Small, K. A. (1994). *NCHRP Synthesis 210: Road pricing and congestion management: A survey of international practice*. Washington, DC: Transport Research Board, National Research Council.

Green, P. E., & Srinivasan, V. (1978). Conjoint analysis in marketing research: New developments and directions. *Journal of Marketing*, *54*, 3-19.

Harrington, W., Krupnick, A. J., & Alberini, A. (2001). Overcoming public aversion to congestion pricing. *Transportation Research A*, *35*, 87-105.

Jakobsson, C., Fujii, S., & Gärling, T. (2000). Determinants of private car users' acceptance of road pricing. *Transport Policy*, *7*, 153-158.

Jones, P. M. (1991). Gaining public support for road pricing through a package approach. *Traffic Engineering and Control*, *32*, 194-196.

Loukopoulos, P., Jakobsson, C., Gärling, T., Schneider, C. M., & Fujii, S. (2005). Public attitudes towards policy measures for reducing private car use. *Environmental Science and Policy*, *8*(1), 57-66.

Louvriere, J. J. (1988). *Analyzing decision making: Metric conjoint analysis*. Beverly Hills, CA: Sage.

Luce, R. D., & Tukey, J. W. (1964). Simultaneous conjoint measurement: A new type of fundamental measurement. *Journal of Mathematical Psychology*, *1*, 1-27.

Lyons, G., Dudley, G., Slater, E., & Parkhurst, G. (2004). *Evidence-base review—Attitudes to road pricing*. Bristol, UK: Centre for Transport & Society.

Noorman, K. J., & Schoot Uiterkamp, A. J .M. (Eds.). (1998). *Green households? Domestic consumers environment and sustainability.* London: Earthscan.

Poortinga, W., Steg, L., Vlek, C., & Wiersma, G. (2003). Household preferences for energy-saving measures: A conjoint analysis. *Journal of Economic Psychology*, *24*(1), 49-64.

Rijksinstituut voor Volksgezondheid en Milieu. (2004). *Greenhouse gas emissions in the Netherlands 1990 - 2002.* Bilthoven, the Netherlands: Author.

Schade, J. (2003). European research results on transport pricing acceptability. In J. Schade & B. Schlag (Eds.), *Acceptability of transport pricing strategies* (pp. 109-123). Amsterdam: Elsevier Science.

Schade, J., & Schlag, B. (2000). *Acceptability of urban transport pricing*. Helsinki, Finland: Valtion Taloudellinen Tutkimuskeskus.

Schade, J., & Schlag, B. (2003). Acceptability of urban transport pricing strategies. *Transportation Research F*, *6*, 45-61.

Schlag, B., & Teubel, U. (1997). Public acceptability of transport pricing. *International Association of Traffic and Safety Sciences Research*, *21*(2), 134-142.

Schuitema, G. (2003). Pricing policies in transport. In L. Hendrickx, W. Jager, & L. Steg (Eds.), *Human decision making and environmental perception: Understanding and assisting human decision making in real-life settings* (pp. 203-222). Groningen, the Netherlands: University of Groningen, Department of Psychology.

Smithson, M. J. (2003). *Confidence intervals*. Thousand Oaks, CA: Sage.

Steg, E. M. (1996). *Gedragsverandering ter vermindering van het autogebruik: Theoretische analyse en empirische studie over probleembesef, verminderingsbereidheid en beoordeling van beleidsmaatregelen* [Behaviour change for reducing the use of motor-cars: Theoretical analysis and empirical study on problem awareness, willingness-to-change and evaluation of policy measures]. Unpublished doctoral dissertation, University of Groningen, the Netherlands.

Steg, L. (1999). *Verspilde energie?* [Wasted energy?] (SCP Report No. 126). Den Haag, the Netherlands: Social and Cultural Planning Office of the Netherlands.

Steg, L. (2003). Factors influencing the acceptability and effectiveness of transport pricing. In J. Schade & B. Schlag (Eds.), *Acceptability of transport pricing strategies* (pp. 187-202). Amsterdam: Elsevier Science.

Steg, L., Dreijerink, L. J. M., & Abrahamse, W. (2005). *Acceptability of energy policies*. Manuscript submitted for publication.

Steg, L., & Vlek, C. (1997). The role of problem awareness in willingness-to-change car use and in evaluating relevant policy measures. In J. A. Rothengatter & E. Carbonell Vaya (Eds.), *Traffic and transport psychology: Theory and application* (pp. 465-475). Oxford, UK: Pergamon.

Stern, P. C., Dietz, T., & Kalof, L. (1993). Value orientations, gender, and environmental concern. *Environment and Behavior*, *25*(3), 322-348.

Stradling, S. G., Meadows, M. L., & Beatty, S. (1999). *Factors affecting car use choices*. Edinburgh, UK: Napier University, Transport Research Group.

Verhoef, E., Koopmans, C., Bliemer, M., Bovy, P., Steg, L., & Van Wee, B. (2004). *Vormgeving en effecten van prijsbeleid op de weg: Effectiviteit, efficiëntie en acceptatie vanuit een multidisciplinair perspectief* [Design and effects of road pricing: Effectiveness, efficiency and acceptability from a multidisciplinary perspective]. Amsterdam: Vrije Universiteit / Strichting Economisch Onderzoek; Delft: Technische Universiteit Delft; Groningen: Rijksuniversiteit Groningen.

Verhoef, E. T. (1996). *Economic efficiency and social feasibility in the regulation of road transport externalities*. Amsterdam: Thesis.

Vringer, K., & Blok, K. (1995). The direct and indirect energy requirements of households in the Netherlands. *Energy Policy*, *23*(10), 893-910.

Wierenga, B., & Van Raaij, W. F. (1987). *Consumentengedrag: Theorie, analyses & toepassingen* [Consumer behaviour: Theory, analyses and applications]. Leiden, the Netherlands: Stenfert Kroese.