Would employees accept curtailments in heating and air conditioning, and why? An empirical investigation of demand response potential in office buildings

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Highlights

- We examine employee support for corporate demand response programs
- Employees generally find curtailments in heating or cooling acceptable
- The level of support is heterogeneous and has multiple underpinnings
- Beliefs about consequences and personal norms directly predict support
- Perceived corporate environmental responsibility also explains support

Abstract

Support for demand response has mostly been investigated in the context of private households. We extend the examination of support to organizational contexts. Specifically, we analyze employee support for a scenario in which employees are faced with temporary heating or air conditioning curtailments in their workplace. We also examine the factors underpinning support, including socio-demographic and workplace characteristics and psychological motivations and beliefs. Our empirical results are based on a sample of 551 employees from different organizations who work in air-conditioned offices. Results indicate that employees generally support corporate demand response programs and are willing to accept small deviations from their ideal office temperature, but the level of support is heterogeneous across employees. Subsequent modeling of potential underlying factors shows that socio-demographic or workplace-related characteristics only play a minor role in explaining these variations. In contrast, psychological factors, including environmental motivations and perceived corporate environmental responsibility underpin support, and specific beliefs about the consequences of participation can directly explain support as well. Moreover, personal norms emerged as an important antecedent of program support. Policy makers and organizations can use these insights to design effective demand response programs that address the relevant drivers and barriers of employee support.

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1. Introduction

The growing urgency of human-induced climate change necessitates a rapid shift towards a more sustainable, low-carbon energy system (IPCC, 2018). In response, many countries have passed climate and energy policies that aim to stimulate more sustainable energy technologies and practices. On the supply side, this includes a transition away from generation based on fossil fuels and towards renewable energy generation. At the same time, electricity demand is increasing due to the electrification of vehicles and heating systems, and the increased use of air conditioning in many industrialized countries. Notably, these transitions greatly increase the intermittency of energy generation (due to weather variations) and energy demand (due to the irregular use of heating or cooling devices; Klaassen et al., 2017). Demand response programs are one solution to counter these fluctuations in supply and demand by stimulating more flexible energy usage (Strbac, 2008)). However, this requires energy consumers to engage in demand response by adjusting their consumption to energy generation and grid conditions (Schuitema et al., 2017; Sintov and Schultz, 2015; Sloot et al., 2023).

Several recent studies have examined the willingness of private households to enroll in demand response programs (e.g., Lehmann et al., 2022; Parrish et al., 2020; Parrish et al., 2019; Sloot et al., 2022) as well as their response to demand response incentives (see Sloot and Scheibehenne, 2022, for a meta-analysis on the effectiveness of financial incentives in promoting demand response). For example, studies have investigated the motivational drivers and barriers to households' interest and intentions to participate in demand response programs, indicating that both financial and environmental motivations could explain participation intentions (Parrish et al., 2020; Sloot et al., 2022). However, while demand response programs in private households are receiving increasing attention from researchers, research on demand response participation in organizational contexts is scarce. For example, Parrish and colleagues (2019) conducted a recent systematic review of drivers and barriers to demand response participation but found few results on small and medium sized businesses. Notably, studies modeling the technical potential of demand response indicate a high theoretical potential of load reductions in the commercial sector, mostly through the widespread use of air conditioning in commercial buildings (e.g., Gils, 2014). It is likely that this potential will increase further in the coming years, as more new buildings are equipped with air conditioning units and heating systems in buildings make the switch to electric heat pumps (IEA, 2022). Given this high potential of the commercial sector, it is crucial to address the research gap on demand response participation in the commercial sector. Enabling the technical potential entails that organizations decide to participate in a given demand response program and, by extension, that the employees affected by these programs are willing to support the given measures. Yet, to date it is largely unclear what barriers demand response policies in organizations would face and what motivations underlie employees' willingness to participate in commercial demand response programs.

This paper aims to address this gap by investigating the willingness of employees in office buildings to participate in demand response programs during their work time, in particular employees' support for a program that would temporarily curtail heating and air conditioning, thus causing deviations from regular indoor temperatures. Our aims are twofold: first, we will assess office employees' level of willingness to participate in demand response programs that curtail office temperatures at times when grid conditions require. We will also assess the degree to which a temperature deviation from ideal conditions would be acceptable when it comes to curtailing heating in winter and air conditioning in summer. Second, we will examine the main factors underlying the level of willingness to gain insights into the drivers and barriers of participation willingness. We thereby extend theories of individual decision making on sustainable behavior by incorporating factors that capture the organizational context in which such demand response programs would operate.

The following Section 2 introduces the concept of demand response in commercial office buildings in more detail and provides a theoretical reasoning for the factors potentially underlying employees' support for temperature curtailments. Section 3 outlines the goals and hypotheses of the current study and Section 4 describes the methods. Results are described in Section 5 and the last section concludes with a summary and discussion of the results, including theoretical and policy implications of this research.

2. Theoretical Background

2.1. Demand response through flexible air conditioner use in office buildings

The commercial sector represents a high share of the electricity consumption in many industrialized countries, with heating and cooling appliances accounting for a significant share of the consumption in commercial buildings (Santamouris, 2016). Despite their high energy demand, commercial buildings also provide a natural energy storage due to thermal inertia and can thus be used to provide flexibility in response to power grid conditions (Hao et al., 2012). Gils (2014) provides an analysis of the theoretical demand response potential across different sectors and European countries and finds that commercial air conditioning provides a large potential for short-term demand reductions. For example, he estimates the potential for load reductions of commercial air conditioning in Germany to be almost 250 MW. With the push toward electrification of the heating sector, high potentials could be expected from heat pumps in the future as well.

Notably, the theoretical potential for load reductions is constrained by certain factors, including national regulations regarding indoor temperature standards.[1] Moreover, while curtailments in heating or cooling could bring about temporary decreases in comfort among

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[1] In Germany, for example, the minimum room temperature depends on the severity of physical work.

office employees, it is unrealistic that organizations would accept temperature deviations that could affect employee productivity. Research has empirically investigated the question of how work productivity is impacted at different indoor temperatures. A meta-analysis by Seppänen and colleagues (2006) shows that productivity is highest around temperatures of 22°C and starts to decrease when temperature are higher than 23-24°C. In contrast, a later meta-analysis by Porras-Salazar and colleagues (2021) that built on that by Seppänen and colleagues and included a larger database of studies found no relationship between indoor temperature and productivity. Notably, the latter study examined a wider temperature range from 18°C to 34°C, thus including temperatures that could be relevant in both heating curtailments in winter and cooling curtailments in summer. In sum, empirical evidence on the temperature-productivity relationship is ambiguous, but it is nevertheless unlikely that organizations would be willing to compromise their employees' productivity at work. Therefore, in this study, we constrained the possible temperature ranges during curtailments to 16°C to 26°C. Within this range, we examine the extent to which employees find demand response programs with temporary temperature curtailments acceptable, and what beliefs (e.g., about possible decreases in productivity or comfort) underlie acceptability. The following section describes these underlying factors in more detail.

2.2. Theories of individual decision making to explain demand response participation

Engagement in demand response is not a single behavior but requires a set of different decisions and behaviors, such as individuals' decision to enroll in a demand response program and their actual response in terms of load reductions or shifting (Parrish et al., 2019; Sloot et al., 2023). In an organizational context, employees are relatively limited in their decision making, as enrollment (and response) are results of corporate policies. Nevertheless, in order for corporate demand response to be successful in the long term, it is important that employees are willing to support a given program, as they are also directly affected by potential curtailments in heating or cooling. In this regard, two aspects are of particular importance: first, employee support can avoid any negative effects on employee satisfaction and thus ensure that the demand response program does not hamper business outcomes (cf. Harter et al., 2002). Second, any corporate policy will likely be less effective if not supported by a large majority of employees, as employees could manually change any prescribed temperature limits or counteract them in other ways (cf. Chou, 2014). Different theories have aimed to explain the acceptability of policies in the context of sustainable energy behavior (Steg et al., 2015; Stern, 2000). Individuals will generally be likely to accept certain policies and engage in sustainable behavior when they perceive the benefits to outweigh the costs. In private households, such beliefs are often assumed to revolve around personal financial costs or benefits from engaging in demand response (Nilsson et al., 2018; Sloot et al., 2022; see also Wolske et al., 2017). However, in a corporate context, beliefs about financial consequences are likely less relevant, as individual employees would not personally profit financially from their organization's participation in a demand response program. However, beliefs about other consequences likely play a role. For example, employees could be more favorable towards a demand response program if they believe that it will have corporate benefits, such as reflecting positively on the public image of their organization. Similarly, employees could weigh the environmental benefits of program participation. On the other hand, perceived costs and risks of program participation likely revolve around feared decreases in workplace comfort and productivity and could hamper employees' willingness to support a demand response program. The present study aims to evaluate the role of these beliefs on employees' support for a corporate demand response program.

Given that demand response contributes to a more sustainable energy system and given the absence of direct financial incentives for individual employees, we reason that employees' support for a corporate demand response program could be explained by theories of intrinsic environmental motivations in particular. These theories, such as Schwartz' norm-activation model (Schwartz, 1977) or value-belief-norm theory (Dietz, 2015; Stern, 2000) commonly assume that people behave in sustainable ways because of a personal norm to do so. Personal norms express a feeling of moral obligation to engage in a certain behavior and are themselves influenced by other factors. The value-belief-norm theory proposes a causal chain in which general values (e.g., altruism, egoism, hedonism) form the motivational basis for more specific beliefs about the consequences and outcomes of certain behaviors, which in turn influence personal norms assumed to be the last step to making a decision or engaging in a sustainable behavior (Stern, 2000; Stern et al., 1999). More recently, Van der Werff & Steg (2016) proposed a more parsimonious adaptation of this theory by introducing the value-identity-personal norm (VIP) model. The VIP model directly links general values and personal norms through the concept of environmental self-identity, which describes the extent to which people see themselves as someone who behaves in a sustainable way. While most studies have examined the validity of the VIP model among private consumers (e.g., in households), we propose that intrinsic motivations – namely general values, environmental self-identity, and personal norms – play an important role for decision making in corporate contexts as well. Some recent empirical evidence supports this reasoning, showing that intrinsic motivations such as environmental self-identity and personal norms can explain private consumers' interest in participating in demand response programs (Parrish et al., 2020; Sloot et al., 2022).

2.3. The importance of organizational factors for demand response in office settings

As indicated above, the decision to support a demand response program in a corporate context is likely associated with different perceived costs and benefits compared to the context of private households. We propose that this context also bears implications for other motivations underlying support. Specifically, employees not only make the decision to support a demand response program based on their intrinsic environmental motivations, but also based on the organizational context that they are part of as employees (Fielding and Hornsey, 2016; Fritsche et al., 2018). They are members of their organization and particular work teams and can identify to a certain extent with these social categories (Ashforth and Mael, 1989; Knippenberg and Schie, 2000). Identification with these group memberships increases the likelihood that employees see the goals of their organization as their own, in consequence aligning their behaviors with organizational goals or policies (see Haslam, 2004). This suggests that employees may be more likely to support a demand response program when they perceive their organization to endorse sustainable goals in general. This is can be reflected in employees' perception of their organization's corporate environmental responsibility (e.g., Ruepert et al., 2017). We therefore propose that the extent to which employees identify with their work team and their organization as a whole, and the extent to which they perceive their organization to endorse environmental goals will increase the likelihood that they support a demand response program in their organization.

3. Current Research

The current research examines to what extent employees in organizations are willing to support a corporate demand response program and what factors can explain the level of support. These questions were investigated via a quantitative online survey with a commercial panel provider. The 551 participants in the study were employed in various companies but had to work in an office with air conditioning to be eligible for participation. We measured employees' level of support in two distinct ways: first, in terms of the extent to which participants would be in favor of their organization adopting a demand response program and, second, by assessing the extent to which they would accept deviating temperatures in summer and winter.

As we tested the predictive power of underlying factors from different theories, we tested the role of the included variables in separate hierarchical steps via partial least squares structural equation modeling. Specifically, we first studied the role of socio-demographic factors including workplace-related characteristics (such as the office type or dress code). Next, we analyzed the influence of general values over and above socio-demographic variables, before adding other environmental and organizational motivations. Lastly, we examined specific beliefs about the introduced demand response program and personal norms. This analytic approach follows the idea that a behavioral outcome is best predicted by variables that are measured at a similar level of specificity, also known as the compatibility principle (Ajzen and Fishbein, 1970). It also corresponds to the predictions made by some of the theories from which we draw. For example, the value-identity-personal norm model proposes a causal chain from general values via environmental self-identity to specific personal norms (Van der Werff and Steg, 2016). In line with this, we predicted that general values would only have a small effect on employees' level of support for the demand response program, which would diminish once more specific predictors were included. Environmental and organizational motivations should predict the level of support over and above general values, but we expected these effects to diminish with the inclusion of specific beliefs and personal norms in the last modeling step. Thus, in the final model including all predictor variables, we expected specific beliefs about program support and personal norms to emerge as the strongest predictors of participants' level of support.

4. Method

4.1. Sample

We recruited participants through a commercial panel company, only allowing those individuals to take part in the study that worked in an office other than their own home and had access to both heating and air conditioning. Participants also had to be between 18 and 67 years old, which represents the age range of the adult working population in Germany. Moreover, we defined a quota that required 50% of the sample to be women and men, respectively.[2] We administered attention and straightlining checks during the survey that removed participants automatically. Overall, 551 participants successfully completed the

[2] As no detailed socio-demographic data is available for our target population (i.e., employees working in air-conditioned offices), the generation of a truly representative sample is not possible.

survey, 17 of which were subsequently removed due to extreme response behavior (e.g., speeding). This resulted in a final sample of 534 participants included in the data analysis (51% female, M_{age} = 43.87 years, SD = 13.97). Table 1 displays further socio-demographic and workplace-related characteristics of the participants, indicating a relatively high level of education and income (median household income: 3,200-4,500€) compared to the national average. Moreover, the sample contains considerable heterogeneity regarding workplace-related characteristics such as the type of office, usual dress code, and company size.

Table 1. *Socio-demographic and workplace-related sample characteristics*

Gender: female		51.0%
Age		
	18-24 years	9.7%
	25-29 years	7.9%
	30-39 years	23.6%
	40-49 years	19.1%
	50-59 years	19.1%
	60 years and older	20.6%
Highest educational degree obtained		
	Without school degree	0.2%
	Lower secondary education	5.4%
	Intermediate secondary education	32.2%
	Higher secondary education	62.2%
Income		
	<900€	2.2%
	900-1500€	5.3%
	1500-2000€	9.4%
	2000-2600€	17.8%
	2600-3200€	16.9%
	3200-4500€	19.2%
	4500-6000€	18.8%
	>6000€	10.4%
Leadership position: yes		28.8%
Office setting		
	Single office	21.7%
	Dual office	17.8%
	Multi-desk office	33.7%
	Open plan office	26.8%
Usual dress code	Formal	9.4%
	Semi-formal	38.2%
	Casual	52.4%
Company size		
	Up to 10 employees	8.8%
	11-50 employees	13.9%
	51-200 employees	21.3%
	201-1000 employees	22.5%
	More than 1000 employees	33.5%
Full-time job (vs. part-time)		73.4%
Percentage of remote work		
	0% (always in office)	38.4%
	20% remote	27.9%
	40% remote	15.9%
	60% remote	11.2%
	80% remote	6.6%

4.2. Procedure

Participants took part in an online survey that consisted of four parts. First, they indicated their agreement with a number of items that captured personal values, environmental motivations, and organizational factors such as the perceived corporate environmental responsibility. Afterwards, a brief text introduced the need for a more flexible energy demand in a changing energy system and highlighted the important role of consumers in providing flexibility. The text then explained that office employees could provide flexibility by curtailing their use of the air conditioning in summer or that of heating in winter. Participants were then asked to indicate the ideal temperature at which they would prefer to work in summer and winter, respectively. The third part of the survey introduced the specific scenario: participants were asked to imagine that their company would participate in a new program that allows the curtailment of heating and air conditioning for a duration of two hours during the work day. It was also explained that the temperature would never drop below 16°C or exceed 26°C despite the program being in place. After reading the scenario, participants answered a range of items capturing specific beliefs about the program, followed by their acceptance of the program and acceptable temperature thresholds for summer and winter, respectively. The survey finished by assessing socio-demographic and workplace-related characteristics.

4.3. Measures

Items were measured using a 7-point Likert scale ranging from 1 (completely disagree) to 7 (completely agree), unless described otherwise. Appendix 1 provides a comprehensive list of all items. Descriptive statistics for the compound scales are displayed in Table 2.

Values. The short value questionnaire by (Steg et al., 2014) measured biospheric, altruistic, egoistic, and hedonic value dimensions with three to five items, respectively. We slightly adapted the response scale so that answers could range from 0 (not important) to 3 (important) to 7 (of utmost importance).

Environmental self-identity. Three items captured the extent to which participants saw themselves as someone who behaves pro-environmentally (Van der Werff et al., 2013).

Organizational identification. Four items captured to what extent participants identified with their organization as a whole, based on the proposed scale by Postmes et al. (2013).

Perceived corporate environmental responsibility (CER). We measured participants' perception that their organization supports sustainability goals (and in particular the energy transition) with four items, loosely based on Rupert et al. (2017).

Work team identification. We adapted the four organizational identification items so that they referred to the level of participants' work team, rather than their organization as a whole.

Personal norms. Three items measured the extent to which participants felt morally obligated to support the energy transition. Items were adapted from Van der Werff & Steg (2016).

Perceived corporate benefits. Two items captured whether participants believed that their company's public image would benefit from participating in the demand response program.

Perceived environmental benefits. Two items measured participants' beliefs that participating in the demand response program would have environmental benefits.

Perceived costs and risks (PCR). Perceived costs and risks were measured with two subscales of two items each. One subscale assessed participants' beliefs that participating in the program would negatively impact their comfort. The second subscale assessed beliefs that participation would negatively affect productivity in the workplace. Due to the high intercorrelation between both subscales (r = .80), they were merged into one scale for the main analysis.

Program support. Participants were asked to imagine that their employer is "considering to participate in a program that allows the flexible control of the air conditioning in summer" and that the "the grid provider is allowed to turn off the air conditioning on certain days". We also stated that despite the temperature curtailment during program participation, the temperature could never exceed 26°C (see Appendix 2 for the full description). Three items then assessed participants' support for the described program. Next, we asked participants to imagine the reverse scenario for heating curtailments in winter (where a minimum temperature of 16°C would be ensured). The same three items then assessed participants' support for the program. Since program support for summer and winter was highly correlated (r = .80), we created an aggregated variable for program support that we used in the main model to ease interpretation.

Table 2. *Overview of descriptive statistics and scale reliabilities for motivations and beliefs*

Variable	***Min.***	***Max.***	***Mean***	***SD***	***No. of items***	**Cronbach's α**
Biospheric values	0	7	5.11	1.35	4	.89
Altruistic values	1	7	5.36	1.14	4	.80
Egoistic values	0	7	3.18	1.39	5	.83
Hedonic values	0.33	7	4.86	1.26	3	.81
Environmental self-identity	1	7	5.16	1.23	3	.92
Organizational identification	1	7	4.90	1.41	4	.91
Perceived CER	1	7	4.56	1.52	4	.95
Work team identification	1	7	5.32	1.35	4	.93
Personal norms	1	7	4.70	1.61	3	.90
Perceived corporate benefits	1	7	4.54	1.55	2	.80
Perceived environmental benefits	1	7	4.96	1.44	2	.78
Perceived costs and risks	1	7	3.88	1.60	4	.89
Program support (summer and winter)	1	7	4.78	1.70	6	.96

Acceptable temperature limit. After introducing the demand response program, we asked participants to indicate their ideal office temperature on a summer (winter) day using two sliders that ranged from 16 to 26°C. The question specified that the ideal winter temperature could be the same as the ideal summer temperature or could be different. Subsequently, we asked participants what the maximum temperature would be that they would still be willing to accept if the air conditioning were curtailed in summer. We used the same slider as for the ideal temperature, but the maximum temperature could not be lower than the ideal temperature participants had indicated before. In the same way, we assessed the minimum temperature that participants would be willing to accept should the heating be curtailed in winter (here, the minimum temperature could not be higher than the previously set ideal temperature).

4.4. Data analysis

Data was analyzed in two steps. First, we examined the overall program support and acceptable temperature limits in summer and winter across all participants by assessing their mean values and distributions. Second, we modeled the influence of underlying factors on program support and the two temperature thresholds. Our analysis thus includes three separate models for these three outcomes, and each model was estimated hierarchically in four steps, adding a set of more specific predictors at each step. In Step 1, the model only included socio-demographic variables, in Step 2 the four general values were added, Step 3 additionally contained other environmental and organizational factors, and Step 4 added personal norms and specific beliefs about the program. This procedure allowed us to gain insights about the importance of variables in different configurations and to observe the incremental amount of variance explained by more specific predictors. To estimate the models, we used partial least squares structural equation modeling (PLS-SEM). In contrast to ordinal least squares regression, PLS-SEM allows the modeling of latent variables and can thus account for measurement error (Hair et al., 2021). Since the main goal of this research is the identification of key drivers and barriers of acceptance, PLS-SEM is a more appropriate analysis method than covariance-based SEM, which focuses more on theory testing and confirmation. In addition, PLS-SEM is better equipped to deal with smaller sample sizes and does not require the data be normally distributed (Hair et al., 2019). We compute these models with the R package *seminr*, specifying all latent constructs as reflective and using bootstrapping with 10,000 draws to create the confidence intervals for significance testing of the parameters. In the description of the results, we focus on the structural part of the model, as the measurement model indicated that indicator loadings, scale reliability values, and discriminant validity of the latent variables were all sufficient (see Appendix 3 for results on the measurement part of the full model).

5. Results

5.1. Willingness to participate in a program with temperature curtailments

Participants supported participation in the program both in summer and winter, as indicated by mean scores for summer (M = 4.90, 95%CI = [4.75; 5.05]) and winter (M = 4.66, 95%CI = [4.50; 4.81]) program support significantly above the scale midpoint of four. A paired-samples t-test indicated that participating in the program in summer received relatively higher support compared to participating in winter (M_{Diff} = 0.24, t(533) = 4.88, p < .001), but this difference represents a very small effect (Cohen's d = 0.13).

Participants' ideal office temperature was relatively normally distributed around a mean of around 21.5°C, with no difference between ideal temperatures in summer and winter (M_{Diff} = -0.03°C, t(533) = -0.25, p = .801). The maximum acceptable temperature on summer days was 23.80°C on average (SD = 1.94, median = 24°C). The minimum acceptable temperature on winter days was 19.10°C on average (SD = 1.89, median = 19°C). We conducted two paired-samples t-tests to compare whether the difference between ideal and acceptable temperatures was statistically significant. The first comparison showed that participants would accept temperatures in summer that are on average 2.40°C higher than their ideal temperature, which represents a statistically significant difference, t(533) = -33.91, p < .001, and a large effect size (Cohen's d = -1.25). Similarly, participants indicated that they would accept temperatures in winter that are 2.33°C lower than their ideal temperature, t(533)

= 35.70, $p < .001$, which also represents a large effect size (Cohen's $d = 1.26$). Figure 1 shows how the differences between ideal and acceptable temperatures were distributed among participants.

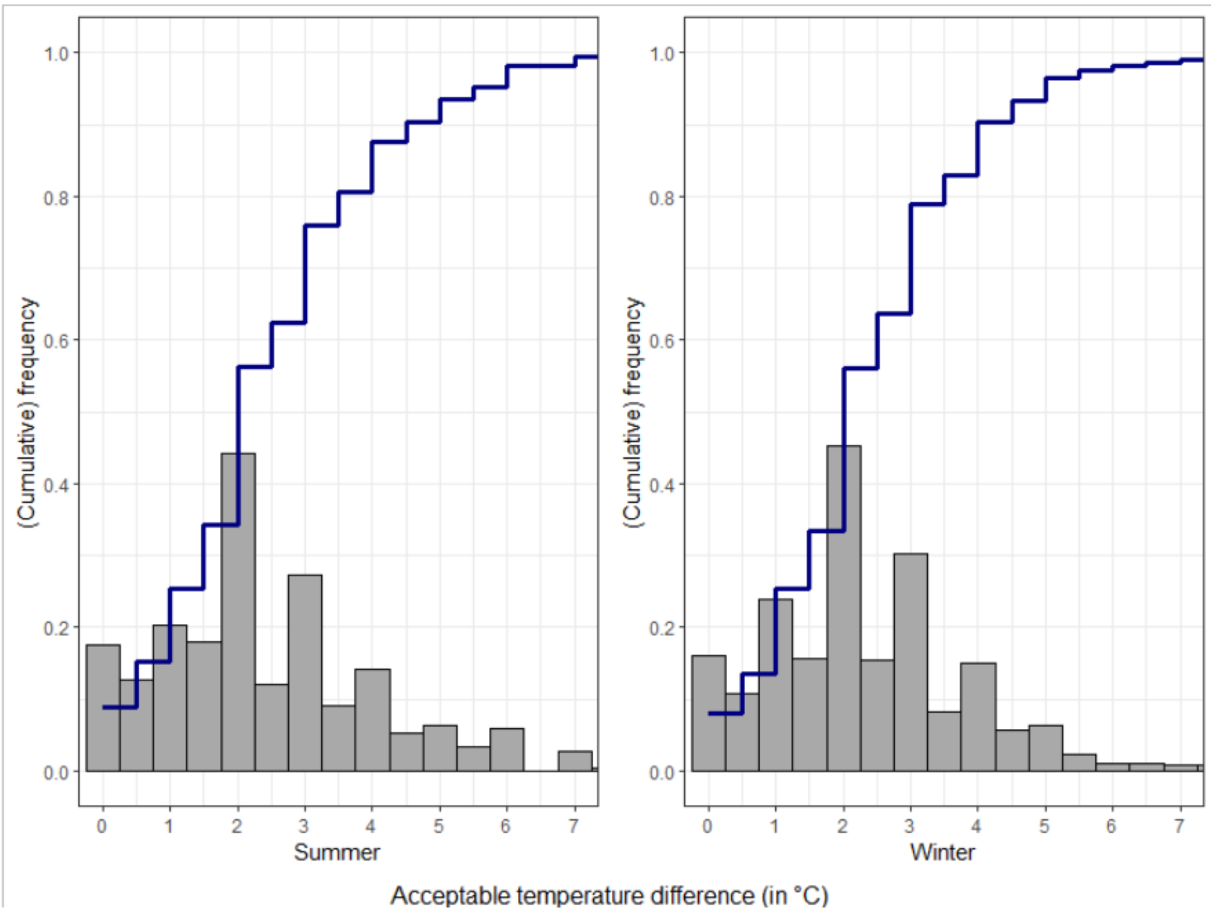

Figure 1. Histograms and cumulative density plots displaying the proportion of participants in relation to acceptable temperature differences

Although the acceptable temperature differences in summer and winter are similar across all participants (i.e., in terms of their mean values), this is not necessarily the case from a within-participant perspective: as the scatterplot in Figure 2 shows, there was only a medium correlation ($r = 0.41$, $p < .001$) between the accepted temperature difference in summer and winter. In other words, many participants had a greater acceptability for curtailments in summer over winter, or vice versa, but not equally for both seasons.

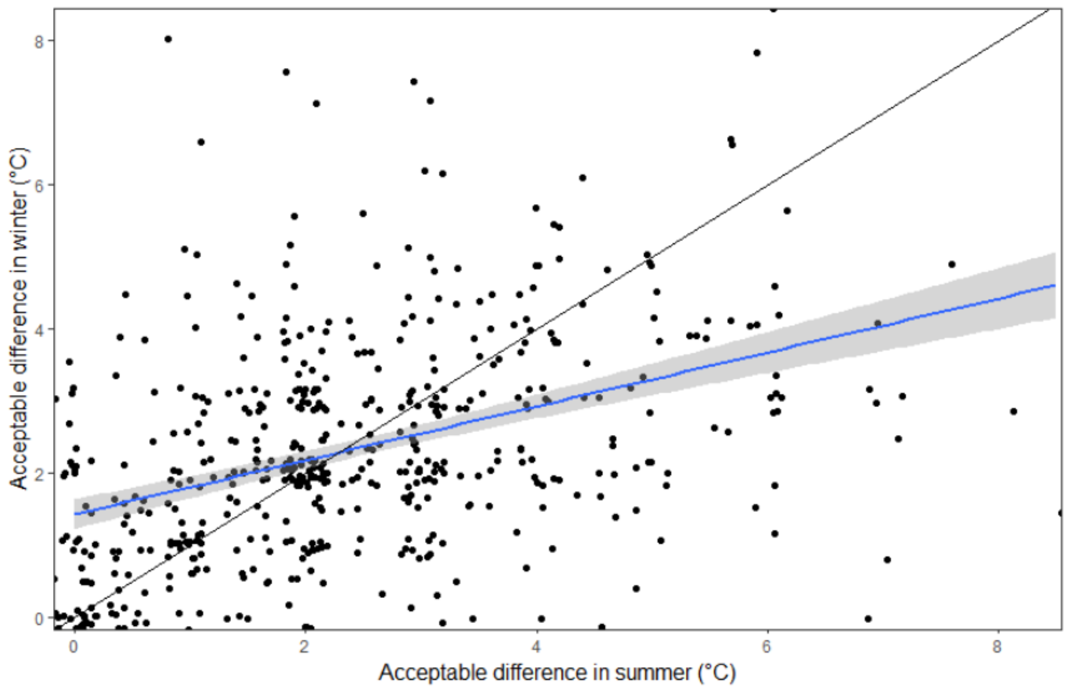

Figure 2. Scatterplot of the acceptable temperatures in summer in winter, with a diagonal line in black and a simple linear regression line in blue.

While the discussed differences between ideal and accepted temperature provide a direct insight into individuals' willingness to accept curtailments, examining the absolute temperature thresholds that are accepted by a certain proportion of people has additional practical value, as office temperatures usually do not reflect individual ideal temperatures. For summer temperatures, our data suggests that the vast majority (88%) of participants would accept temperatures above 22°C and about two-thirds (63%) would accept temperatures above 24°C. From there on, acceptance sharply declines, with only 17% of participants finding temperatures of 26°C or higher acceptable. Acceptable temperature ranges are narrower in winter compared to summer. While most participants (79%) would accept temperatures at or below 20°C, about half (58%) would accept 19°C or less and 40% of employees find temperatures at or below 18°C acceptable. These average values reflect a wide distribution of acceptable temperatures across individuals. Thus, it is of both theoretical and practical value to identify the factors underlying individual differences in acceptable temperatures.

5.2. Factors explaining support for program participation

An analysis of value inflation factors (VIF) indicated that collinearity between predictors was not an issue in any of the modeling steps, with the VIFs of all continuous predictors being smaller than 3. Table 3 displays the PLS-SEM results for program support (see Appendix 4 for bivariate correlations between all constructs). Step 1 of the model showed that socio-demographic predictors did not contribute to the explanation of program support, with the exception of a small effect of age, suggesting that older employees are slightly more likely to support the curtailment program. In Step 2, biospheric values emerged as the only significant value dimension predicting program support, indicating that stronger biospheric values are linked to stronger support. Overall, Step 2 could explain over 10% of the variance in program support. Interestingly, the inclusion of values rendered the effect of age insignificant, such that no socio-demographic predictors played a role in explaining program support. Biospheric values remained a significant predictor in Step 3, despite the inclusion of environmental self-identity in this step, the latter only being marginally significant. Among the organizational factors included in this step, only perceived corporate environmental responsibility had a significant effect, indicating that program support was stronger when employees perceived a stronger corporate environmental responsibility of the organization for which they were working. In contrast, organizational identification or work team identification did not affect program support. In Step 4, we included personal norms and specific beliefs, which are often assumed to be direct proximate antecedents of the intentions or behaviors they predict. In line with predictions, personal norms and all three of the included beliefs about the program showed a significant effect on program support, rendering all previous effects of the other predictors non-significant (with the exception of a negative effect of company size in this step). Specifically, the more employees perceived corporate as well as environmental benefits of the program, the more support they showed for the program. Conversely, perceiving costs and risks in the form of negative workplace comfort and productivity consequences was strongly related to decreased program support. Lastly, the more employees had a personal norm to support the energy transition, the more they supported the program. Although this effect was somewhat smaller than the effects of the program beliefs, it indicates that employees' personal (moral) norms matter even when accounting for the specific beliefs about the program's consequences. Overall, the specific predictors included in Step 4 could explain almost two-thirds of the variance in program support.

Table 3. *PLS-SEM results for program support*

	Step 1		Step 2		Step 3		Step 4	
	β	95%CI	β	95%CI	β	95%CI	β	95%CI
Gender: women (vs. men)	-0.02	[-0.12; 0.07]	-0.05	[-0.14; 0.04]	-0.05	[-0.14; 0.04]	-0.03	[-0.09; 0.03]
Age	0.10*	[0.02; 0.19]	0.00	[-0.09; 0.09]	-0.01	[-0.10; 0.08]	0.03	[-0.04; 0.08]
Education level	0.09	[-0.01; 0.19]	0.08	[-0.02; 0.17]	0.07	[-0.02; 0.16]	-0.01	[-0.07; 0.05]
Income	0.01	[-0.09; 0.12]	0.05	[-0.04; 0.14]	0.06	[-0.04; 0.16]	0.02	[-0.04; 0.08]
Leadership role: yes	0.00	[-0.11; 0.11]	-0.02	[-0.12; 0.09]	-0.03	[-0.13; 0.07]	0.02	[-0.05; 0.08]
Office: dual (vs. single)	-0.01	[-0.12; 0.11]	-0.02	[-0.12; 0.08]	-0.01	[-0.11; 0.09]	-0.02	[-0.09; 0.04]
Office: multi	0.05	[-0.08; 0.18]	-0.01	[-0.13; 0.11]	-0.01	[-0.13; 0.11]	-0.04	[-0.12; 0.03]
Office: open-plan	0.03	[-0.10; 0.16]	-0.01	[-0.14; 0.11]	-0.02	[-0.14; 0.10]	0.01	[-0.08; 0.08]
Dress code: business casual (vs. formal)	0.09	[-0.09; 0.26]	0.10	[-0.06; 0.25]	0.08	[-0.07; 0.22]	0.03	[-0.07; 0.13]
Dress code: casual	0.08	[-0.11; 0.26]	0.07	[-0.09; 0.23]	0.06	[-0.08; 0.22]	0.00	[-0.11; 0.11]
Company size	-0.05	[-0.14; 0.05]	-0.05	[-0.14; 0.04]	-0.07	[-0.16; 0.02]	-0.07*	[-0.13; -0.01]
Job: full-time (vs. part-time)	-0.02	[-0.11; 0.07]	-0.01	[-0.09; 0.07]	0.00	[-0.08; 0.09]	0.02	[-0.04; 0.07]
Percentage of remote work	-0.01	[-0.10; 0.08]	-0.02	[-0.10; 0.07]	-0.03	[-0.11; 0.05]	-0.02	[-0.08; 0.05]
Biospheric values			0.29*	[0.16; 0.40]	0.17*	[0.01; 0.31]	0.01	[-0.09; 0.10]
Altruistic values			0.10	[-0.03; 0.21]	0.08	[-0.04; 0.19]	0.00	[-0.07; 0.08]
Egoistic values			-0.01	[-0.15; 0.14]	-0.03	[-0.16; 0.13]	0.00	[-0.09; 0.10]
Hedonic values			-0.14	[-0.24; 0.09]	-0.12	[-0.23; 0.09]	0.01	[-0.06; 0.07]
Environmental self-identity					0.13	[0.00; 0.26]	-0.03	[-0.12; 0.06]
Organizational identification					-0.09	[-0.21; 0.08]	-0.04	[-0.12; 0.06]
Perceived CER					0.14*	[0.01; 0.26]	0.03	[-0.05; 0.10]
Work team identification					0.09	[-0.05; 0.20]	0.04	[-0.04; 0.11]
Personal norm							0.17*	[0.08; 0.26]
Perceived corporate benefits							0.24*	[0.16; 0.31]
Perceived environmental benefits							0.26*	[0.18; 0.36]
Perceived costs and risks							-0.39*	[-0.46; -0.31]
Observations	534		534		534		534	
R^2	.02		.14		.17		.64	
$R^2_{adjusted}$	.00		.11		.14		.63	

Note. Coefficients represent standardized beta coefficients; significance of the coefficients is determined via the 95% confidence intervals estimated through bootstrapping; asterisks indicate significance at the .05 level.

5.3. Factors explaining acceptable temperature limits

In the second model, we examined the effects of the four sets of predictors on acceptable temperature limits in summer. Again, VIF values below 3 for all continuous predictors indicated that multicollinearity was not a concern. To account for individual differences in ideal temperatures, we included ideal summer temperatures as a covariate in the model, which was strongly related to the acceptable maximum temperature in all model steps, as expected. Thus, the regression explains absolute acceptable temperature and not differences from ideal temperature, but statistically controls for the influence of ideal temperatures.

Among the socio-demographic variables in Step 1, education, income, and dress code had a significant effect on the outcome (see Table 4 for all results on acceptable summer temperatures). Specifically, employees with a higher education and income and those employees who do not have to wear formal business clothes for their job accepted higher temperature limits and thus more curtailment through the program. Among the values included in Step 2, only egoistic values emerged as a significant predictor of acceptable temperature limits. As expected, this effect was negative, indicating that people with stronger egoistic values found the curtailment of temperatures less acceptable. Contrary to expectations, biospheric or hedonic values were not significantly related to the level of acceptability. Similarly, none of the environmental or organizational factors included in Step 3 were significantly related to acceptable temperature levels. The amount of incremental variance explained by Steps 2 and 3 was practically zero, suggesting that general personal motivations (values, environmental and organizational factors) are generally no good predictors of acceptable temperature limits. In line with this, neither personal norms nor perceived environmental benefits contributed to the explanation of temperature limits in Step 4. However, perceiving higher corporate benefits from the program and less personal costs and risks in terms of comfort and productivity losses was associated with higher acceptable temperatures and thus greater curtailment through the program. Overall though, Step 4 only led to a very small gain in incremental variance explained by these proximate predictors.

Table 4. *PLS-SEM results for acceptable temperatures in summer*

	Step 1		Step 2		Step 3		Step 4	
	β	95%CI	β	95%CI	β	95%CI	β	95%CI
Ideal summer temperature	0.62*	[0.55; 0.68]	0.61*	[0.54; 0.66]	0.60*	[0.53; 0.66]	0.58*	[0.52; 0.64]
Gender: women (vs. men)	-0.03	[-0.1; 0.04]	-0.03	[-0.10; 0.04]	-0.04	[-0.11; 0.03]	-0.03	[-0.10; 0.04]
Age	0.02	[-0.05; 0.09]	-0.04	[-0.11; 0.04]	-0.04	[-0.11; 0.03]	-0.03	[-0.11; 0.04]
Education level	0.12*	[0.05; 0.2]	0.12*	[0.04; 0.18]	0.10*	[0.03; 0.17]	0.08*	[0.01; 0.15]
Income	0.08*	[0.00; 0.16]	0.10*	[0.02; 0.17]	0.09*	[0.01; 0.16]	0.08*	[0.01; 0.16]
Leadership role: yes	-0.08	[-0.17; 0.00]	-0.07	[-0.15; 0.01]	-0.08	[-0.16; 0.01]	-0.07	[-0.15; 0.02]
Office: dual (vs. single)	0.01	[-0.07; 0.09]	0.00	[-0.08; 0.07]	0.00	[-0.08; 0.07]	0.00	[-0.08; 0.07]
Office: multi	0.02	[-0.08; 0.11]	-0.02	[-0.11; 0.08]	-0.02	[-0.12; 0.07]	-0.03	[-0.13; 0.06]
Office: open-plan	0.03	[-0.06; 0.13]	0.00	[-0.09; 0.09]	-0.01	[-0.10; 0.08]	0.01	[-0.08; 0.09]
Dress code: business casual (vs. formal)	0.13*	[0.00; 0.25]	0.12*	[0.00; 0.24]	0.14*	[0.01; 0.25]	0.12	[0.00; 0.22]
Dress code: casual	0.16*	[0.03; 0.29]	0.13*	[0.00; 0.26]	0.16*	[0.02; 0.27]	0.13	[-0.01; 0.24]
Company size	-0.05	[-0.12; 0.02]	-0.06	[-0.13; 0.01]	-0.05	[-0.13; 0.02]	-0.05	[-0.13; 0.02]
Job: full-time (vs. part-time)	0.01	[-0.05; 0.08]	0.02	[-0.05; 0.08]	0.02	[-0.05; 0.08]	0.02	[-0.04; 0.09]
Percentage of remote work	0.01	[-0.06; 0.07]	0.01	[-0.05; 0.08]	0.02	[-0.05; 0.08]	0.02	[-0.05; 0.08]
Biospheric values			0.05	[-0.05; 0.15]	0.02	[-0.09; 0.14]	-0.02	[-0.12; 0.1]
Altruistic values			0.07	[-0.08; 0.17]	0.05	[-0.09; 0.16]	0.03	[-0.10; 0.13]
Egoistic values			-0.13*	[-0.21; -0.06]	-0.14*	[-0.21; -0.06]	-0.13*	[-0.20; -0.05]
Hedonic values			0.00	[-0.09; 0.07]	0.01	[-0.08; 0.08]	0.04	[-0.04; 0.11]
Environmental self-identity					0.05	[-0.04; 0.15]	0.00	[-0.09; 0.09]
Organizational identification					0.09	[-0.15; 0.15]	0.09	[-0.14; 0.15]
Perceived CER					-0.04	[-0.13; 0.06]	-0.07	[-0.15; 0.04]
Work team identification					0.04	[-0.06; 0.15]	0.04	[-0.06; 0.14]
Personal norm							0.08	[-0.02; 0.18]
Perceived corporate benefits							0.11*	[0.03; 0.19]
Perceived environmental benefits							-0.03	[-0.12; 0.07]
Perceived costs and risks							-0.14*	[-0.22; -0.06]
Observations	534		534		534		534	
R^2	.44		.46		.48		.51	
$R^2_{adjusted}$	.42		.45		.45		.49	

Note. Coefficients represent standardized beta coefficients; significance of the coefficients is determined via the 95% confidence intervals estimated through bootstrapping; asterisks indicate significance at the .05 level.

In the third model, we examined the effects of the same sets of predictors on acceptable temperature limits in winter. Analogous to the previous model, multicollinearity was not of concern. Individual differences in winter temperature were included as a covariate in the model and were strongly related to acceptable temperature limits, as expected. We note that the interpretation of the effects is now reversed, in that a significant negative effect of a predictor indicates the acceptability of *lower* temperature limits and thus greater willingness to curtail, whereas positive effects indicate a lesser willingness to curtail.

Step 1 of the model showed only a small yet significant effect of age, suggesting that older employees are less accepting of lower temperature limits (see Table 5 for all results on acceptable winter temperatures). This effect was also present in Step 2 and was accompanied by a second effect of higher income being associated with lower acceptable temperature limits. Contrary to expectations, biospheric values were not significantly related to acceptable temperature levels, although we found marginal effects of both egoistic and hedonic values. This provides some evidence that those with stronger egoistic and hedonic values are less accepting of lower temperature limits, as would be expected. None of the environmental or organizational factors in Step 3 were significantly associated with acceptable winter temperature levels, which is a similar finding to the model assessing acceptable temperatures in summer. In Step 4, only personal norms emerged as a significant predictor of temperature limits, whereas none of the specific beliefs about the program had a significant effect. Specifically, those with a stronger personal norm to support the energy transition accepted lower temperature limits and thus greater curtailment through the program. We note, however, that the incremental variance explained by the four sets of predictors over and above the contribution of ideal office temperatures was low, particularly in comparison to the first model on overall program support.

Table 5. *PLS-SEM results for acceptable temperatures in winter*

	Step 1		Step 2		Step 3		Step 4	
	β	95%CI	β	95%CI	β	95%CI	β	95%CI
Ideal winter temperature	0.67*	[0.61; 0.73]	0.66*	[0.59; 0.71]	0.65*	[0.59; 0.7]	0.64*	[0.58; 0.7]
Gender: women (vs. men)	0.05	[-0.02; 0.11]	0.06	[0.00; 0.13]	0.08*	[0.01; 0.14]	0.08*	[0.01; 0.14]
Age	0.09*	[0.02; 0.16]	0.14*	[0.07; 0.22]	0.15*	[0.08; 0.22]	0.14*	[0.07; 0.22]
Education level	-0.06	[-0.13; 0.02]	-0.05	[-0.12; 0.03]	-0.03	[-0.11; 0.03]	-0.02	[-0.09; 0.04]
Income	-0.06	[-0.13; 0.01]	-0.08*	[-0.15; -0.01]	-0.08*	[-0.15; -0.01]	-0.07	[-0.14; 0.00]
Leadership role: yes	0.04	[-0.03; 0.12]	0.04	[-0.04; 0.11]	0.06	[-0.02; 0.13]	0.05	[-0.03; 0.12]
Office: dual (vs. single)	-0.01	[-0.09; 0.06]	0.00	[-0.08; 0.07]	0.00	[-0.08; 0.07]	0.00	[-0.08; 0.07]
Office: multi	-0.07	[-0.16; 0.02]	-0.04	[-0.13; 0.05]	-0.03	[-0.12; 0.05]	-0.02	[-0.11; 0.06]
Office: open-plan	-0.05	[-0.14; 0.04]	-0.02	[-0.11; 0.07]	-0.01	[-0.10; 0.07]	-0.02	[-0.10; 0.07]
Dress code: business casual (vs. formal)	-0.06	[-0.18; 0.06]	-0.07	[-0.18; 0.05]	-0.09	[-0.20; 0.04]	-0.07	[-0.18; 0.05]
Dress code: casual	-0.07	[-0.20; 0.05]	-0.07	[-0.19; 0.06]	-0.10	[-0.21; 0.03]	-0.08	[-0.19; 0.04]
Company size	-0.01	[-0.08; 0.06]	-0.01	[-0.08; 0.06]	-0.02	[-0.08; 0.06]	-0.01	[-0.08; 0.06]
Job: full-time (vs. part-time)	0.00	[-0.08; 0.07]	-0.01	[-0.08; 0.07]	-0.01	[-0.08; 0.06]	-0.01	[-0.08; 0.06]
Percentage of remote work	0.02	[-0.05; 0.08]	0.02	[-0.04; 0.08]	0.03	[-0.04; 0.09]	0.03	[-0.03; 0.09]
Biospheric values			0.00	[-0.11; 0.06]	0.05	[-0.07; 0.14]	0.09	[-0.03; 0.18]
Altruistic values			-0.14	[-0.23; 0.05]	-0.12	[-0.2; 0.06]	-0.09	[-0.18; 0.07]
Egoistic values			0.07	[0.00; 0.15]	0.09*	[0.02; 0.17]	0.09*	[0.02; 0.17]
Hedonic values			0.07	[0.00; 0.14]	0.06	[-0.01; 0.12]	0.03	[-0.04; 0.10]
Environmental self-identity					-0.09	[-0.16; 0.01]	-0.03	[-0.12; 0.08]
Organizational identification					-0.09	[-0.16; 0.10]	-0.09	[-0.17; 0.10]
Perceived CER					0.03	[-0.07; 0.10]	0.05	[-0.05; 0.12]
Work team identification					-0.06	[-0.16; 0.03]	-0.05	[-0.15; 0.03]
Personal norm							-0.13*	[-0.22; -0.03]
Perceived corporate benefits							-0.04	[-0.12; 0.04]
Perceived environmental benefits							0.01	[-0.09; 0.10]
Perceived costs and risks							0.06	[-0.01; 0.14]
Observations	534		534		534		534	
R^2	.47		.50		.52		.53	
$R^2_{adjusted}$	.46		.48		.50		.51	

Note. Coefficients represent standardized beta coefficients; significance of the coefficients is determined via the 95% confidence intervals estimated through bootstrapping; asterisks indicate significance at the .05 level.

6. Discussion

The aim of the present research was to gain insights into the motivational underpinnings of corporate programs that curtail office temperatures to provide flexibility to the electricity system. Investigating if employees would be willing to support such programs, and why, has practical importance for at least two reasons. First, the energy transition towards more fluctuating generation from renewables and electrified demand increases the challenge to balance energy generation and demand, and demand response via curtailments in heating or air conditioning is one way of helping to achieve such a balance (Strbac, 2008). Second, and exacerbated by the current energy market situation, reductions in energy consumptions can help alleviate increased energy costs and supply risks. Behavioral insights into the potential of curtailments are necessary to inform the design of effective policies and programs. This research aimed to generate such insights by examining environmental and organizational motivations in particular that could explain employee support for demand response programs. While most previous research has focused on private households as flexibility providers in demand response programs, we address an important gap regarding the potential of such programs in commercial organizations.

6.1. Summary and theoretical implications

Our findings indicate that employees would generally be willing to participate in a demand response program that involves temporary curtailments in heating and air conditioning. Next to the overall level of support, we estimated how much curtailment employees would be willing to accept, using self-reported ratings to quantify deviations from individual ideal temperatures. We find that deviations in the range of 2.0-2.5°C are seen as acceptable.[3] While these acceptable deviations are on average similar for curtailments in

[3] We note that this quantification of acceptable temperature deviations is based on self-reported ratings and will discuss the possible limitations of this method further in Section 6.2.

summer and winter, there is a considerable amount of heterogeneity between participants, indicating that it is important to uncover what factors can explain these variations.

Our model results show distinct profiles of underlying motivations and beliefs for each of the three outcomes we examined, namely program support, and acceptable summer and winter temperatures. For program support, socio-demographic factors play no significant role. Instead, and as expected, environmental motivations (biospheric values) and organizational motivations (perceived corporate environmental responsibility) can explain variations in support, and specific beliefs about the program as well as personal norms emerge as the best direct predictors of program support. In contrast, for acceptable summer temperatures, socio-demographic characteristics (i.e., education and income) and workplace-related characteristics (i.e., dress code at work) play a more important role. General motivational factors, on the other hand, play a minor role, with the exception of a negative relationship between egoistic values and acceptable summer temperatures. Perceived corporate benefits and perceived costs and risks (but not personal norms) emerge as direct predictors. Taken together, these results provide no indication of a moral motivational underpinning of acceptable summer temperatures, instead suggesting that more rational considerations regarding personal and organizational costs and benefits predict this outcome. Finally, acceptable winter temperatures are not explained by socio-demographic factors. Similar to the results for acceptable summer temperatures, egoistic values are the only motivations predicting this outcome. Moreover, none of the specific beliefs about consequences play a role, but personal norms emerge as a direct predictor of winter temperatures. Overall, this indicates that moral considerations play a more important role for curtailments in heating in winter and a lesser role for curtailments in air conditioning in summer.

These results bear a few additional implications for theory development. Theories to explain sustainable behavior have been most extensively tested in contexts of private decision making, focusing on individual consumers or households (Dietz et al., 2009; Steg, 2023; but see, for example, Goedkoop et al., 2021; Ruepert et al., 2016). Our results corroborate a growing body of research showing that these theories extend to other contexts including decision making in corporate workplaces. Our findings show that this is particularly the case for personal norms, which are frequently considered a key factor of normative decision making (Stern, 2000; Van der Werff and Steg, 2016). This finding corresponds to recent research indicating that personal norms mediate the relationship between organizational factors (e.g., CER) and sustainable behavior (Sharpe et al., 2022). Moreover, organizational or team identification plays a smaller role than expected, which is contrary to theories of group identification and their relationship with sustainable behavior (Fielding and Hornsey, 2016; Fritsche et al., 2018; Masson and Fritsche, 2014; Sloot et al., 2018). However, this lack of relationship could be due to the varying types of organizations that participants belonged to, which likely have very different corporate environmental goals. Future research could examine the relationship between organizational identification and support for corporate demand response in more detail by studying particular organizations and taking into account specific identities, goals, and policies. Future research could also explore the distinct profiles of factors underpinning overall program support and acceptable temperatures in summer and winter, and link these profiles to existing theories on sustainable behavior. For example, construal-level theory (CLT) distinguishes between high construal levels that involve abstract evaluations based on general goals or moral principles and low construal levels that involve more specific evaluations based on short-term interest (Wiesenfeld et al., 2017). This distinction could be reflected in the different assessments of corporate demand response programs, namely (abstract) program support and (specific) acceptable temperature limits. It would be consistent with CLT that program support is underpinned by more abstract and moral motivations, whereas temperature limits are associated with more specific short-term interests such as perceived costs and risks (although we note that this is only the case for acceptable summer temperatures) (Wang et al., 2021).

6.2. Limitations and future research

Our data is based on a sample consisting exclusively of employees working in offices with access to both heating and air conditioning. This represents a strength in terms of the validity of our findings, as the people in our sample are likely familiar with the status quo of the scenario described in our study. However, as demand response is still a relatively new concept particularly in corporate contexts, our participants have not actually experienced the curtailments described by the scenarios. Therefore, we were only able to measure hypothetical support, rather than actual decision making or acceptance of certain temperature limits. This presents a potential bias, as employees' actual level of support may deviate from the hypothetical support captured by our study (and likewise, the stated ideal temperatures may deviate from actual ideal temperatures). Nevertheless, insights on hypothetical support are important, as employee support is necessary both before the start of a future demand response program and during an actual program (Parrish et al., 2019; Schuitema et al., 2017; Sloot et al., 2023). Moreover, these insights can inform the a-priori design of specific programs.

The hypothetical nature of our scenarios particularly applies with respect to the acceptable temperature limits. We relied on self-reports, and employees might not be able to accurately judge their temperature limits, as awareness of specific room temperatures likely varies between employees. We tried to counter this issue by first asking for ideal temperature ratings and subsequently asking for acceptable temperature limits in summer and winter (while showing the ideal temperatures that participants had previously reported). This questionnaire design means that participants could directly see the difference between ideal and acceptable temperatures, and their rating of the acceptable temperatures thus serves as an indicator of how much of a sacrifice they are willing to make in terms of accepting higher or lower temperatures. Nevertheless, it is important that future research complements our study with different methods, such as experimentally manipulating temperatures in actual office settings or in controlled lab environments. Moreover, pilot studies could introduce demand response programs in organizations and evaluate the response by employees.

7. Conclusions and Policy Implications

Similar to other climate and energy policies, successfully implementing demand response programs will entail the support of the employees affected by the curtailments. Therefore, it is crucial to estimate the level of support that can be expected and gain insights into the drivers and barriers of support. Our findings indicate that employees would generally support corporate demand response programs and the level of support can be explained by a variety of psychological underpinnings. This has important implications for policy and program design. First, even though support is generally positive, it is heterogeneous between employees, suggesting that one-size-fits-all solutions may not be universally effective. Instead, the effectiveness of a given program in terms of implementation and response can likely be increased by careful program designs that consider the respective target group of employees. Importantly, our results do not suggest that particular workplace types (e.g., smaller or bigger companies, office design, etc.) will affect employee support. Instead, it is mostly psychological motivations and beliefs that determine the level of support. For organizations, this implies that support could be fostered by creating a salient corporate environmental identity, leading employees to perceive a strong corporate environmental responsibility of their company. Organizations can then aim to align new demand response programs with this identity. Moreover, employees' personal motivations can play an important role as well. The central role of personal norms for program support and curtailments in winter suggests that organizations could appeal to these norms, for example, by highlighting employees' existing environmental motivations or the environmental benefits that can be generated by participating in a program. Our analysis also identified perceived risks to workplace productivity and comfort as a main barrier of corporate demand response programs. It is thus important to alleviate these concerns, and organizations could address them by providing workplace comfort in general, among others. Notably, we find that curtailments in summer and in winter are motivated by different factors: acceptance for curtailments in air conditioning is mostly underpinned by rational beliefs and perceived risks, whereas acceptance for curtailments in heating is motivated by moral considerations (personal norms). This suggests that it might be more effective to disentangle these two versions of demand response, and programs might be more effective if they only address one or the other. Taken together, these findings provide novel insights into the underlying drivers and barriers of employee support for corporate demand response programs that can inform the design of policies and specific programs in an effective manner.

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Appendix

Appendix 1. Comprehensive list of scales and items

Biospheric values

1. Respecting the earth: harmony with other species
2. Unity with nature: fitting into nature
3. Protecting the environment: preserving nature
4. Preventing pollution: protecting natural resources

Altruistic values

1. Equality: equal opportunity for all
2. A world at peace: free of war and conflict
3. Social justice: correcting injustice, care for the weak
4. Helpful: working for the welfare of others

Egoistic values

1. Social power: control over others, dominance
2. Wealth: material possessions, money
3. Authority: the right to lead or command
4. Influential: having an impact on people and events
5. Ambitious: hardworking, aspiring

Hedonic values

1. Pleasure: joy, gratification of desires
2. Enjoying life: enjoying food, sex, leisure etc.
3. Self-indulgent: doing pleasant things

Environmental self-identity

1. Acting environmentally friendly is an important part of who I am
2. I am the type of person who acts environmentally friendly
3. I see myself as an environmentally friendly person

Personal norms

1. I feel morally obliged to support the sustainable energy transition.
2. I would feel guilty if I did not contribute to the sustainable energy transition.
3. I would feel proud to contribute to the sustainable energy transition.

Corporate environmental responsibility (CER)

1. My company tries to advance the goals of the energy transition.
2. My company supports the goals of the energy transition.
3. My company aims to use energy in a sustainable way.
4. My company has the goals to prevent negative effects on the climate as much as possible.

Organizational identification

1. I identify with my company.
2. I feel committed to my company.
3. I am glad to be part of my company.
4. Being part of my company is an important part of how I see myself.

Work team identification

1. I identify with my work team
2. I feel committed to my work team

3. I am glad to be part of my work team.
4. Being part of my work team is an important part of how I see myself.

Perceived corporate benefits

1. I expect positive effects on my company's image if my company participated in the program.
2. My company would look better in the public eye if it participated in the flexible temperature control.

Perceived environmental benefits

1. Participation in the program could help in mitigating climate change.
2. A more flexible control of the air conditioning and heating would be good for the energy transition.

Perceived costs and risks (productivity)

1. Curtailments of the air conditioning/heating would have grave consequences on my workplace productivity.
2. Participation in the program would have negative effects on my concentration at work.

Perceived costs and risks (comfort)

1. Participation in the program would limit my comfort.
2. If there were curtailments of the air conditioning/heating, I would not feel comfortable in my workplace.

Support for program participation

1. I would support the participation of my company in such a program.
2. I am willing to accept curtailments of the air conditioning (heating) in my office due to the program.
3. I would recommend the program to my colleagues.

Appendix 2. Description of the curtailment scenarios

Scenario description for summer curtailments:

> Now imagine the following case:
>
> Your employer is considering participating in a program that allows **flexible control of air conditioning in the summer**. Your office is air-conditioned on summer days, which means you work at a preset room temperature that is usually kept constant.
>
> By participating in the program, the network operator can **switch off the air conditioning** on certain days. During this time, the office is not cooled for a certain period of time. The exact period is unknown in each case. However, there is a **limit**: The temperature in the office must **never exceed 26°C**. Up to this value there can be a loss of comfort, but scientific studies show that productivity in the workplace is only impaired at even higher temperatures.

Scenario description for winter curtailments:

> Now imagine the opposite case:
>
> Your employer is considering participating in a program that allows **flexible control of heating in winter**. Your office is heated on winter days, meaning you work at a preset room temperature that is usually kept constant.
>
> By participating in the program, the network operator can **turn off the heating** on certain days. During this time, the office is not heated for a certain period of time. The exact period is unknown in each case. However, there is a limit: The temperature in the office must **never be less than 16°C**. Up to this value, there can be a loss of

comfort, but scientific studies show that productivity in the workplace is only impaired at even lower temperatures.

Appendix 3. Results of the measurement model predicting program support (final step)

Table A3.1. *Indicator loadings for the final model predicting program support*

	Program support	Biospheric values	Altruistic values	Egoistic values	Hedo-nic values	Environ-mental self-identity	Perso-nal norms	Org. identi-fication	Perce ived CER	Team identi-fication	Perceived corporate benefits	Perceived environ-mental benefits	PCR
SupportSummer_r1	0.92	0	0	0	0	0	0	0	0	0	0	0	0
SupportSummer_r2	0.92	0	0	0	0	0	0	0	0	0	0	0	0
SupportSummer_r3	0.93	0	0	0	0	0	0	0	0	0	0	0	0
SupportWinter_r1	0.91	0	0	0	0	0	0	0	0	0	0	0	0
SupportWinter_r2	0.91	0	0	0	0	0	0	0	0	0	0	0	0
SupportWinter_r3	0.91	0	0	0	0	0	0	0	0	0	0	0	0
ValueScale_bio_r1	0	0.86	0	0	0	0	0	0	0	0	0	0	0
ValueScale_bio_r2	0	0.81	0	0	0	0	0	0	0	0	0	0	0
ValueScale_bio_r3	0	0.91	0	0	0	0	0	0	0	0	0	0	0
ValueScale_bio_r4	0	0.89	0	0	0	0	0	0	0	0	0	0	0
ValueScale_alt_r5	0	0	0.81	0	0	0	0	0	0	0	0	0	0
ValueScale_alt_r6	0	0	0.74	0	0	0	0	0	0	0	0	0	0
ValueScale_alt_r7	0	0	0.86	0	0	0	0	0	0	0	0	0	0
ValueScale_alt_r8	0	0	0.75	0	0	0	0	0	0	0	0	0	0
ValueScale_ego_r9	0	0	0	0.63	0	0	0	0	0	0	0	0	0
ValueScale_ego_r10	0	0	0	0.90	0	0	0	0	0	0	0	0	0
ValueScale_ego_r11	0	0	0	0.65	0	0	0	0	0	0	0	0	0
ValueScale_ego_r12	0	0	0	0.70	0	0	0	0	0	0	0	0	0
ValueScale_ego_r13	0	0	0	0.70	0	0	0	0	0	0	0	0	0
ValueScale_hed_r14	0	0	0	0	0.98	0	0	0	0	0	0	0	0
ValueScale_hed_r15	0	0	0	0	0.67	0	0	0	0	0	0	0	0
ValueScale_hed_r16	0	0	0	0	0.67	0	0	0	0	0	0	0	0
ESI_r1	0	0	0	0	0	0.94	0	0	0	0	0	0	0
ESI_r2	0	0	0	0	0	0.92	0	0	0	0	0	0	0
ESI_r3	0	0	0	0	0	0.92	0	0	0	0	0	0	0

PN_r1	0	0	0	0	0	0	0.92	0	0	0	0	0	0
PN_r2	0	0	0	0	0	0	0.92	0	0	0	0	0	0
PN_r3	0	0	0	0	0	0	0.90	0	0	0	0	0	0
CER_r1	0	0	0	0	0	0	0	0.91	0	0	0	0	0
CER_r2	0	0	0	0	0	0	0	0.89	0	0	0	0	0
CER_r3	0	0	0	0	0	0	0	0.86	0	0	0	0	0
CER_r4	0	0	0	0	0	0	0	0.88	0	0	0	0	0
OI_r5	0	0	0	0	0	0	0	0	0.94	0	0	0	0
OI_r6	0	0	0	0	0	0	0	0	0.92	0	0	0	0
OI_r7	0	0	0	0	0	0	0	0	0.93	0	0	0	0
OI_r8	0	0	0	0	0	0	0	0	0.94	0	0	0	0
TI_r1	0	0	0	0	0	0	0	0	0	0.93	0	0	0
TI_r2	0	0	0	0	0	0	0	0	0	0.91	0	0	0
TI_r3	0	0	0	0	0	0	0	0	0	0.90	0	0	0
TI_r4	0	0	0	0	0	0	0	0	0	0.89	0	0	0
Beliefs_CB_r1	0	0	0	0	0	0	0	0	0	0	0.93	0	0
Beliefs_CB_r2	0	0	0	0	0	0	0	0	0	0	0.90	0	0
Beliefs_EB_r3	0	0	0	0	0	0	0	0	0	0	0	0.91	0
Beliefs_EB_r4	0	0	0	0	0	0	0	0	0	0	0	0.90	0
Beliefs_PCR_r5	0	0	0	0	0	0	0	0	0	0	0	0	0.83
Beliefs_PCR_r6	0	0	0	0	0	0	0	0	0	0	0	0	0.90
Beliefs_PCR_r7	0	0	0	0	0	0	0	0	0	0	0	0	0.87
Beliefs_PCR_r8	0	0	0	0	0	0	0	0	0	0	0	0	0.89

Note. For better readability, socio-demographic variables included in the model are not displayed in the table because they did not represent latent constructs.

Table A3.2. *Construct reliability and convergent validity of the latent constructs*

	alpha	rhoC	AVE	rhoA
Biospheric values	0.89	0.92	0.75	0.90
Altruistic values	0.80	0.87	0.62	0.81
Egoistic values	0.83	0.84	0.52	1.20
Hedonic values	0.81	0.83	0.62	2.08
Environmental self-identity	0.92	0.95	0.86	0.94
Organizational identification	0.91	0.93	0.78	0.94
Perceived corporate environmental responsibility	0.95	0.96	0.87	0.97
Team identification	0.93	0.95	0.82	0.94
Personal norms	0.90	0.94	0.84	0.90
Perceived corporate benefits	0.80	0.91	0.83	0.81
Perceived environmental benefits	0.78	0.90	0.82	0.78
Perceived costs and risks	0.89	0.93	0.76	0.90
Program support	0.96	0.97	0.84	0.96

Table A3.3. Discriminant validity (HTMT values) for the model predicting program support (final step)

	Biospheric values	Altruistic values	Egoistic values	Hedonic values	Environmental self-identity	Organizational identification	Perceived CER	Work team identification	Personal norms	Perceived corporate benefits	Perceived environmental benefits	PCR
Altruistic values	0.75											
Egoistic values	0.08	0.13										
Hedonic values	0.24	0.32	0.49									
Environmental self-identity	0.76	0.45	0.06	0.07								
Organizational identification	0.19	0.26	0.29	0.15	0.24							
Perceived CER	0.26	0.23	0.15	0.12	0.39	0.61						
Work team identification	0.24	0.37	0.19	0.11	0.24	0.74	0.45					
Personal norms	0.64	0.52	0.08	0.07	0.70	0.19	0.33	0.26				
Perceived corporate benefits	0.32	0.29	0.07	0.07	0.34	0.15	0.32	0.17	0.50			
Perceived environmental benefits	0.46	0.37	0.07	0.09	0.43	0.11	0.27	0.19	0.70	0.78		
PCR	0.17	0.10	0.27	0.23	0.18	0.03	0.05	0.05	0.25	0.37	0.50	
Program support	0.34	0.27	0.07	0.05	0.34	0.11	0.22	0.17	0.54	0.67	0.77	0.65

Appendix 4. Bivariate correlations

Table A4.1. *Bivariate correlations between constructs*

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Biospheric values																
2. Altruistic values	.63**															
3. Egoistic values	-.01	-.02														
4. Hedonic values	.20**	.26**	.40**													
5. Environmental self-identity	.69**	.39**	-.00	.04												
6. Organizational identification	.17**	.22**	.25**	.13**	.22**											
7. Perceived CER	.24**	.20**	.13**	.11*	.36**	.57**										
8. Work team identification	.22**	.32**	.17**	.09*	.23**	.68**	.42**									
9. Personal norms	.57**	.44**	.03	.04	.64**	.18**	.31**	.24**								
10. Perceived corporate benefits	.27**	.23**	.04	.04	.29**	.12**	.28**	.14**	.42**							
11. Perceived environmental benefits	.38**	.29**	-.03	.05	.36**	.09*	.23**	.16**	.58**	.62**						
12. PCR	-.15**	-.08	.24**	.19**	-.16**	-.02	-.05	-.03	-.22**	-.31**	-.41**					
13. Program support	.32**	.24**	-.05	-.04	.32**	.10*	.21**	.16**	.50**	.59**	.66**	-.61**				
14. Acceptable summer temperature	.09*	.06	-.20**	-.10*	.12**	.00	.01	.05	.19**	.19**	.25**	-.29**	.34**			
15. Acceptable winter temperature	-.10*	-.07	.17**	.14**	-.16**	-.01	-.03	-.07	-.19**	-.17**	-.18**	.23**	-.28**	-.15**		
16. Ideal summer temperature	.05	-.02	-.12**	-.12**	.06	.02	.04	.03	.07	.04	.16**	-.15**	.15**	.64**	.16**	
17. Ideal winter temperature	-.07	.03	.14**	.15**	-.13**	.07	.01	.01	-.04	-.09*	-.07	.17**	-.15**	.05	.67**	.09*

Note. * $p < .05$. ** $p < .01$.