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Caring for you vs. caring for the planet: Empathic concern and emotions associated with energy-saving preferences in Singapore

Swati Sharma [a,b,*], Georgios Christopoulos [a,c]

[a] Future Resilient Systems, Singapore-ETH Centre, 1 Create Way, CREATE Tower, Singapore 138602, Singapore
[b] Institute of Catastrophe Risk Management, Interdisciplinary Graduate Programme, Nanyang Technological University, 50 Nanyang Avenue, Singapore 639798
[c] Decision, Environmental and Organizational Neuroscience (DEON) Lab, Nanyang Business School, Nanyang Technological University, 50 Nanyang Avenue, Singapore 639798

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ABSTRACT

The influence of financial and legislative factors on energy-saving decisions is well-established. However, consumers can also be (de-)motivated when they have to appreciate the consequences of their energy-saving behaviors on others – for instance, increasing the air-conditioner temperature could affect children's thermal comfort. Here, we report that higher levels of empathic concern – a basic human disposition to experience warmth and concern for others – are associated with energy-saving behavior. We carried out three experimental studies (Study 1: N = 174, Study 2: N = 171, Study 3: N = 175) involving realistic decision-making scenarios that required balancing energy use in a space with other occupants' needs. Crucially, participants' energy-saving behavior was associated with their level of empathic concern when the energy-use decisions affected others (co-workers or family members), despite that behavior also being influenced by monetary considerations or the need to ensure the comfort of others. Moreover, the effect was independent and principally, additive to the influence of pro-environmental attitudes. These results improve existing models of energy-saving behavior by highlighting that, beyond financial and legislative motives, the capacity to consider and act on other's welfare could drive energy-saving behavior – even at the expense of the comfort of co-workers and family.

1. Introduction

Household energy consumption accounts for approximately one-fifth of total energy consumption in advanced economies, and the proportion is even higher in developing countries [1]. The slow but steady adoption of energy-efficient appliances has contributed to reducing household energy use in some countries. However, unbalanced housing growth will likely boost aggregate energy consumption in the residential sector, especially in countries with less-developed energy-efficiency policies. For instance, household electricity demand is growing at an average annual rate of 4.4% in Southeast Asia, where the residential sector is forecasted to become the largest electricity consuming sector by late 2030 [2]. Thus, residential energy-efficiency becomes essential to achieve overall energy-savings targets, reduce anthropogenic greenhouse gas emissions, address climate change, and achieve a sustainable future [3,4].

Environmental policies and interventions aiming to alter residential energy use mostly rely on a combination of financial incentives, legislation, and technological improvements [5,6], with limited success [7,8]. Similarly, environmental campaigns and persuasive appeals to promote energy-saving behavior are often based on an underlying model of decision processes that rely on financial and self-interest mechanisms [9].

However, decisions with societal impact (such as energy-saving behavior) have a pronounced social element. After all, the main reason for adopting energy efficiency and making clean energy choices is long-term and collective welfare. For instance, pro-environmental behavior might be driven by social motives, personal norms (such as moral obligations), feelings of a 'warm glow' (psychological reward in the form of positive feelings), or the sense of environmental self-identity [9–16]. While moral obligations, warm glow, positive self-image, and other similar factors have their distinct meanings, they share a core construct, i.e., the feeling of self-reward, people 'feeling good' about themselves following a morally correct behavior [17–19]. However,

* Corresponding author at: Institute of Catastrophe Risk Management, Interdisciplinary Graduate Programme, Nanyang Technological University, 50 Nanyang Avenue, Singapore 639798
E-mail addresses: SWATI005@e.ntu.edu.sg (S. Sharma), CGeorgios@ntu.edu.sg (G. Christopoulos).

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accounting for others' welfare with the ultimate goal of improving their well-being is an expression of altruistic motivation. This is facilitated by, or even requires, a high level of empathic concern [20,21], a personality trait that signifies a tendency to experience feelings of warmth, compassion, and concern for others [22].

If energy-saving behavior is at least partly motivated by societal concerns, empathic concern could be a leading mechanism for explaining this. Understanding the effect of empathic concern on energy-related behavior is critical for building a comprehensive cognitive model of the decision processes leading to energy (in)efficient behavior. People differ in their empathic tendencies, influenced by a unique combination of genetic and environmental influences that drive engagement in empathy-related processes and behaviors [23]. Thus, this study aims to understand the role of individual differences in empathic concern in shaping energy-saving behavior.

Empathy is generally defined as the ability to understand and experience others' feelings from their frame of reference rather than from one's own and is essential for forming intimacy, generativity, and trust [24,25]. A person cannot understand another person's thoughts and feelings and cannot care for them without empathy [26]. Empathic concern not only enables individuals to comprehend and share the feelings of others but, critically, also drives them to take actions to help [23,27,28].

Empathic concern acts as a positive moral emotion that supports reasoning and induces the tendency to visualize oneself in another person's situation, prompting a corresponding behavioral correction [29]. Individuals with greater empathic concern are more likely to evaluate the adverse consequences of their actions on others and take this under consideration when deciding on crucial matters [30]. Considerable evidence has demonstrated that empathic concern is associated with pro-social behavior, such as volunteering, raising money for good causes, and freely offering help to those in need [21,31–34].

Nevertheless, studies have also highlighted that in addition to the material expense, empathy comes at a cognitive cost. Sharing someone's feelings and taking actions to meet one's empathic goals involves both physical and mental work. Additionally, feeling empathic toward others involves uncertainty and may cause distress. These associated costs could lead to avoidance of empathic actions, especially when aimed at strangers or a group of people instead of a single individual [35–37]. Evidence, however, has been mixed suggesting that empathy avoidance might be contextually sensitive.

Another critical consideration comes from the finding that empathy seems to decrease with the object's group size. Slovic [38] calls this phenomenon the 'collapse of compassion'. Cameron and Payne [36] showed that this occurs under specific motivational conditions, such as when showing compassion is expected to be overwhelming (e.g., satisfying the needs of larger groups), and when helping is financially costly. This is highly relevant for environmental decisions where the impact of individual or even small group behaviors might be perceived as meaningless in the face of staggering global ecological deterioration. In such situations, people might actively suppress their emotions, and avoid empathy, sometimes even for a single individual.

Along the same lines, various studies have highlighted the role of relationship context in empathy. For instance, Maner and Gailliot [39] demonstrated that people show more empathic behavior towards their kin than strangers. Cameron et al. [35] showed that empathy, while cognitively taxing, is initiated when empathic actions are rewarding (e.g., they favor kin) and associated with more meaning and commitments. Other evidence indicates that people show more empathy when the object is physically present, e.g., they are more likely to give money to a homeless person than donate to a faceless charity [40]. It has also been suggested that empathic concern could be adaptively motivated by indirect in-group benefits, particularly as a facilitator of cooperation [41].

A small yet significant body of research has highlighted that humans can empathize with the earth and ecosystems [42,43]. Specifically, Geiger et al. [44] showed that witnessing environmental destruction elicits a similar type of empathic response in humans to seeing fellow humans or animals suffering. Similarly, Schultz [45] found that taking the perspective of an animal harmed by pollution increased individuals' environmental concerns. Berenguer [46] noted that greater empathy towards natural objects was associated with more willingness to act in a way that protects the environment.

Nevertheless, Berenguer [47] found contrasting moral reasoning about ecological dilemmas when people empathized with natural objects versus human beings. The study showed that when the object of empathy was a vulture, compared to a young man, the number of moral arguments of an ecocentric nature increased, that is, reasoning focused on protecting nature because of its intrinsic value. Similar findings are reported by Tam [48]. In their review of emerging evidence on the role of empathy in sustainability, Brown et al. [49] argue that the motivation to conserve the environment may be hindered by a lack of empathy for nature and others. Furthermore, Pfattheicher [50] demonstrated that compassion for human suffering is associated with pro-environmental values, intentions, and donations to environment-oriented organizations.

Based on these findings, we argue that since detrimental environmental consequences can harm others, people with greater empathic concern might take the consequences of their actions more seriously. Empathic concern might drive them to act responsibly and adopt energy-saving behaviors out of their concern for others' well-being. We hypothesize that individuals with greater empathic concern are more likely to opt for higher energy-savings. We test our principal hypothesis in several boundary conditions.

Previous research has suggested that empathic concern is contextually sensitive, with a strong bias towards kinship and in-groups, e.g., [35,39,41]. Other environment-focused studies have likewise highlighted the role of relationship context in empathic concern (e.g., [47,49]). Here, we test the effect of empathic concern on energy-saving behavior in relation to co-workers, typically a group that is strongly characterized by synergistic motivational benefits. We also examine the effect of empathic concern in its most potent form: when strong kinship is involved (family members).

We tested our primary hypothesis by carrying out three experimental studies in which we presented participants with diverse and socially complex decision-making scenarios involving conflicting emotions related to participants' immediate kin (i.e. family) and close in-groups (i.e. co-workers). We designed the experiments to test whether the association of empathic concern with energy-saving behavior exists and whether this association would survive in boundary conditions i.e. when participants are faced with the needs of (i) close in-groups with high synergistic features (co-workers) or (ii) family, a group expected to elicit a conflicting and strong empathic response involving their immediate comfort.

2. Overview of hypothesis

Our primary hypothesis stated that individuals with greater empathic concern are more likely to opt for higher energy-savings. Thus, in Study 1, we focused on understanding participants' energy-saving preferences for themselves and how it varies with their level of empathic concern. In Study 2, we assessed whether those with greater empathic concern would continue to prioritize energy-saving options when organizational policies clearly emphasize employees' comfort. In this case, ensuring co-workers' immediate comfort might be driven by the motivation to support in-group cooperation. In Study 3, we challenged individuals with a more complex scenario where energy-saving choices conflicted with their family members' comfort. A typical example is the scenario where a parent needs to decide whether to use air-conditioning. This situation creates a conflict: not using air-conditioning is the energy-saving choice, but it might cause discomfort for the children. The strongest form of kinship might drive a parent with greater empathic concern to prioritize the children's needs, as this

results in a more rewarding and certain outcome.

Thus, our questions for studies 2 and 3 were whether people with greater empathic concern would prioritize the feelings and comfort of close in-groups with high synergistic features or immediate kin over the more global and long-term consequences to everyone. We expected that if empathic concern plays a role in shaping energy-saving behavior, those with greater empathic concern should show more energy-saving preferences, irrespective of whether they are making energy-use decisions for themselves, co-workers, or family.

3. Methods

3.1. Procedure and design

We first tested our primary hypothesis by examining participants' energy-use preferences for themselves and how it varies with their level of empathic concern (Study 1). In Study 2, participants were presented with a scenario where they needed to make energy-use decisions for their colleagues, while also following the organizational policies of ensuring employees' comfort and convenience. Study 3 required participants to make energy-use decisions for their families. As energy-saving options might impact the comfort of family members such as parents or children, this scenario involved a substantial emotional conflict of deciding against the comfort of family members.

All three studies were conducted between 14 February 2019 and 14 March 2019 through an online questionnaire. Participants were members of the Qualtrics panel in Singapore. Qualtrics provides a widely used web-based survey tool and maintains a pool of more than 90 million panel respondents in approximately 20 countries on five continents of the world. As in many studies, Qualtrics invited participants according to our pre-specified demographic criteria: resident Singaporean, aged 22 or older (i.e. above the age of majority in Singapore). Participants received monetary compensation for their time.

Participants were invited all at once and were provided with an online participation link. Before they could start, participants were required to complete the electronic informed consent form. Participants were then able to start filling out the questionnaire, interrupt it, and continue at a convenient time until the required number of responses were collected. To ensure high-quality data collection, we programmed several checks e.g., screening criteria, attention checks, speeder checks, and straightlining checks. Participants who failed any of these checks were removed from the study. The questionnaire was in English.

To estimate the required sample size for our study, we examined existing studies of a similar nature, (e.g., [6,21]). The sample size in these studies varied between 44 and 80 participants. We took into consideration the fact that these studies were laboratory-based experiments which would typically reduce the error due to the more homogeneous environment compared to online delivery of questionnaires (as in our case). We also noted that the previous analyses were not multiple regressions controlling for possible confounding parameters. We judged that the reported effect sizes could be distorted and adopted a conservative approach based on these considerations. We increased our sample size by over 100% relative to the largest reported study, requiring a minimum of 160 participants.

A power analysis based on Cohen's framework for multiple regression and correlation [51] indicates that to achieve a statistical power of 0.80 with a significance level of 0.05, a sample size of 54–171 participants is required to detect a small to medium effects size (0.05–0.15) for the effect of empathic concern over and above that of demographic and attitudinal variables. The considered total effect size was 0.14 to 0.22, typical in social psychology studies (e.g., [52]). R^2 estimates were based on published studies of the same nature, specifically Sardianou [53] and Mills and Schleich [54]. The sample size in our three studies varied between 171 and 175, which exceeds the upper bound indicated by power analysis.

In each study, we asked participants to state their energy-use preferences in a decision-making scenario. We measured their empathic concern with standardized metrics, alongside assessments of their general ecological and climate change-related concern. We also recorded participants' general demographic details (e.g., age and gender) and household characteristics (e.g., whether they owned or rented their residence).

Table 1
Socio demographics of the sample and the resident population of Singapore.

	Sample			Resident population of Singapore [a]
	Study 1	Study 2	Study 3	
Age (median)	33.5	35	37	41.1
22–24	8.05%	4.09%	2.85%	–
25–34	44.25%	42.10%	39.42%	14.44%
35–44	27.58%	29.82%	29.71%	14.94%
45–54	16.66%	18.71%	20.57%	15.23%
55–64	3.44%	5.26%	6.85%	14.54%
65	–	–	0.57%	–
Gender: Female	43.10%	47.36%	45.14%	51.10%
Marital Status: Married	57.47%	52.63%	61.14%	59.90
Education				
University education or higher	62.60%	57.89%	54.28%	31.60%
Diploma or professional qualification	27.01%	23.39%	27.42%	15.1%
Post-secondary school education	4.00%	8.77%	5.14%	9.10%
Secondary or below	6.32%	9.94%	13.14%	44.30%
Housing Type				
Housing & Development Board (HDB) flats	83.33%	78.36%	81.14%	78.70%
Household size	3.63	3.67	3.43	3.24
Home-owners	87%	85.54%	85.71%	91%
Ethnic groups				
Chinese	81.39%	80.70%	76.57%	74.40%
Malay	7.56%	12.28%	12.00%	13.4%

[a] Source: [55]. The fraction of the resident population in the specific age group of 22–24 and 65 years is not available.

4. Study 1: deciding for themselves

Study 1 tested the primary hypothesis: that empathic concern is positively associated with energy-saving preferences.

4.1. Participants

Following the quality-control screening, we included 174 resident Singaporean aged between 22 and 65 years in the study. The sample included 99 men and 75 women, with a mean age of 36 years (SD = 9.56). Compared to Singapore's resident population, our sample included a higher proportion of young people (less than half of the sample was between 25 and 34 years old; one-sample test for a difference in proportions: $z = 11.19$, $p < .001$) and people with a high education level ($z = 8.80$, $p < .001$). Women were underrepresented, comprising 43% of our sample, compared to approximately 51% of Singapore's resident population [55] ($z = -2.22$, $p = .026$). The mean household size (3.63) was larger than the national mean of 3.24 ($z = -4.37$, $p < .001$). Our sample included 87% homeowners, similar to the national figure of 91% ($z = -1.58$, $p = .112$).

The proportions of the married people and the people living in public housings were also representative of the resident population ($z = -0.65$, $p = .513$; $z = 1.49$, $p = .135$, respectively). The Malay ethnic group was underrepresented ($z = -2.30$, $p = .021$). Table 1 contains detailed demographic information. Most participants completed the full questionnaire. Less than 4% failed to answer some questions. Due to item non-response, the number of observations reported in the results might differ.

Table 2
Items reflecting overall energy-saving preferences, empathic concern, and attitudinal variables.

Main variables	
	M (*SD*)
Overall energy-saving preferences (OESP, Cronbach's alpha = 0.79)	5.07 (0.74)
Switching off lights in unused rooms	
Electrical appliances not on standby	
Energy-efficient air conditioner	
Energy-efficient refrigerator	
Energy-efficient washing machine	
Line drying of laundry	
CFL/LEDs for home lighting	
Shorter showers	
Regionally grown vegetables and fruits	
Optimum air conditioner temperature	
Minimal use of air conditioner	
Not using energy-intensive presents such as cut flowers	
Dish cleaning by hand	
Walk or cycle for short distances (<2.5 km)	
Walk or cycle for medium distances (<5km)	
Econometer in the car	
Fuel-efficient car	
Hybrid or electric car	
Travel by public transport	
Car-pool and shared taxi ride	
Using public transport for overseas holiday travel	
Using road or train transport for intercity travel during overseas holidays	
Empathic concern (Cronbach's alpha = 0.69)	2.96 (0.42)
When I see someone being taken advantage of, I feel kind of protective toward them	
When I see someone being treated unfairly, I sometimes do not feel very much pity for them (R)	
I often have tender, concerned feelings for people less fortunate than me	
I would describe myself as a pretty soft-hearted person	
Sometimes I do not feel sorry for other people when they are having problems (R)	
Other people's misfortunes do not usually disturb me a great deal (R)	
I am often quite touched by things that I see happen	
Control variables	
	M (*SD*)
General ecological concern (Cronbach's alpha = 0.62)	2.98 (0.50)
The so-called "ecological crisis" facing humankind has been greatly exaggerated (R)	
The earth is like a spaceship with very limited room and resources	
If things continue on their present course, we will soon experience a major ecological catastrophe	
The balance of nature is strong enough to cope with the impacts of modern industrial nations (R)	
Humans are severely abusing the environment	

Note: R: Items were reverse coded for analysis.

Table 3
Zero-order correlations: Overall energy-saving preferences (OESP), empathic concern, and control variables.

	OESP	Empathic concern	General ecological concern	Climate change concern
OESP	1.00			
Empathic concern	0.37***	1.00		
Age	0.35***	0.07	0.04	−0.05
Gender	0.09	0.14	0.05	−0.09
Education level	0.19	0.09	0.26***	0.32***
Employment	0.12	0.12	0.09	0.23**
Marital status	0.06	−0.07	−0.06	0.04
Income level	0.12	0.15	0.20**	0.21**
Housing type	−0.70	0.04	0.22**	0.12
Home-ownership status	0.33***	0.19*	0.08	0.15
Household size	0.04	0.17*	0.05	0.11
General ecological concern	0.36***	0.41***	1.00	0.44***
Climate change concern	0.28***	0.18*	0.44***	1.00

4.2. Decision scenarios and measures

We presented participants with the following decision scenario:

"Suppose you live alone in your flat or apartment. As no-one else stays with you, you can make your household decisions yourself. Keeping this in your mind, please answer the following questions."

Overall energy-saving preferences. After reading the scenario, participants were asked to state their energy-use preferences using an established 22-item questionnaire reflecting personal preferences for energy-saving behavior (adapted from Poortinga et al. [56,57]), modified for the cultural and urban characteristics of the Singaporean population. The questionnaire assessed participants' preferences for the following energy conservation methods: energy efficient purchases such as buying an energy-efficient air conditioner, behavior change such as not leaving electrical appliances on standby, and shifting consumption patterns such as buying regionally grown vegetables (see Table 2 for the full list of items and the online appendix question for the exact question wording).

Participants indicated their responses on a seven-point semantic differential scale, where higher values corresponded to a preference for greater energy-saving (1 = most energy-intensive option, 7 = most energy-efficient option). We averaged the scores for the 22 items (Cronbach's alpha = 0.79) to form an index representing overall energy saving preferences (OESP: $M = 5.07$, $SD = 0.74$).

Empathic concern. We measured participants' level of empathic concern with the established seven-item scale developed by Davis [58] to measure individual differences in empathic concern. This scale assessed participants' feelings of warmth, compassion, and concern for others with seven questions (see Table 2 for items). Participants indicated the extent to which each statement described them on a four-point scale (1 = does not describe me at all to, 4 = describes me very well). Higher values indicate greater empathic concern. We calculated the mean score across all seven items (Cronbach's alpha = 0.69) to represent participants' overall empathic concern ($M = 2.96$, $SD = 0.42$).

Control variables

Demographic characteristics. Several studies (e.g., [59,60]) have shown that demographic factors such as age, education, and income impact people's willingness to adopt renewable energy technologies and energy-efficient systems. To accommodate this in our analysis, we controlled for general demographics and household characteristics. The general demographic variables included age, gender, education level, employment status, marital status, and income. Household characteristics comprised housing type, home-ownership status (owning or renting a house), and the household size.

Attitudinal variables. To account for potential confounding factors [61], we also measured participants' general and specific ecological concerns. General ecological concern was measured using a shorter five-item version [62] of the New Ecological Paradigm scale [63] that covers all facets of an ecological worldview: the reality of growth limits, anti-anthropocentrism, the fragility of nature's balance, rejection of exceptionalism, and the possibility of an eco-crisis. Participants indicated their responses on a four-point Likert scale ranging from 'strongly

Table 4
Regressions of overall energy-saving preferences (OESP) on empathic concern.

	Model (1)				Model (2)				Model (3): Main model			
Dependent variable = OESP	*b* (*SE*)	*β*	*t*	*p*	*b* (*SE*)	*β*	*t*	*p*	*b* (*SE*)	*β*	*t*	*p*
Demographic characteristics												
Age	0.03 (0.01)	0.44	5.91	< 0.001	0.03 (0.01)	0.40	5.53	< 0.001	0.03 (0.01)	0.39	5.65	< 0.001
Gender	−0.04 (0.09)	−0.03	−0.44	0.658	−0.05 (0.09)	−0.03	−0.53	0.599	−0.09 (0.09)	−0.06	−1.00	0.319
Education level	0.26 (0.06)	0.31	4.64	< 0.001	0.18 (0.05)	0.21	3.49	0.001	0.19 (0.05)	0.22	3.92	< 0.001
Employment	0.17 (0.15)	0.08	1.08	0.283	0.14 (0.16)	0.07	0.93	0.356	0.08 (0.15)	0.04	0.53	0.597
Marital status	−0.26 (0.12)	−0.17	−2.17	0.032	−0.16 (0.11)	−0.11	−1.49	0.140	−0.13 (0.10)	−0.09	−1.22	0.225
Income level	0.03 (0.10)	0.02	0.27	0.791	−0.00 (0.10)	−0.00	−0.03	0.978	−0.01 (0.09)	−0.01	−0.07	0.945
Housing type	−0.11 (0.05)	−0.16	−2.37	0.019	−0.14 (0.05)	−0.21	−3.03	0.003	−0.13 (0.05)	−0.20	−2.87	0.005
Home-ownership status	0.50 (0.19)	0.23	2.66	0.009	0.47 (0.17)	0.21	2.76	0.007	0.40 (0.17)	0.18	2.32	0.021
Household size	0.05 (0.05)	0.09	1.19	0.237	0.05 (0.04)	0.08	1.09	0.275	0.03 (0.04)	0.04	0.62	0.537
Attitudinal variables												
General ecological concern					0.38 (0.10)	0.26	3.65	< 0.001	0.27 (0.10)	0.18	2.57	0.011
Climate change concern					0.12 (0.09)	0.09	1.31	0.191	0.13 (0.09)	0.10	1.46	0.147
Variable of interest												
Empathic concern									0.34 (0.10)	0.19	3.36	0.001
R-squared	0.30				0.38				0.41			
Adjusted *R*-squared	0.26				0.34				0.37			
R-squared change	–				0.08				0.03			
F-stat	9.55				10.40				11.63			
p	< 0.001				< 0.001				< 0.001			
AIC	331.9				315.3				309.5			
No. of observations	168				168				168			

Notes: OESP is an index measuring the overall energy-saving preferences of the participants. It varies continuously, where larger values correspond to higher energy-saving preferences. The empathic concern index varies continuously, where larger values correspond to higher empathic concern. Regression coefficients, both raw (*b*) and standardized (*β*) are reported. Robust standard errors (SE) are also reported.

disagree' to 'strongly agree'. We calculated the mean score across all five items (Cronbach's alpha = 0.62) to represent participants' general ecological concern ($M = 2.98$, $SD = 0.50$).

We measured concern about climate change (i.e., a specific ecological concern) with a single item "How serious a problem, do you think climate change- an aspect of global warming mainly caused by greenhouse gas emissions due to human activities - is at this moment?" Participants indicated their responses on a three-point scale, choosing between 'not a serious problem', 'a serious problem', or 'a very serious problem' (see Table 2 for item descriptions).

4.3. Results

4.3.1. Zero-order correlations and linear regression analysis

Various analyses, as detailed below, confirmed that participants with greater empathic concern had a significantly stronger preference for energy-saving behavior. First, a bivariate correlation analysis showed that greater empathic concern was associated with a higher OESP score ($r = 0.37$, $p < .001$, see Table 3). This result was confirmed by subsequent linear regression analysis (see Table 4 for results). We followed a hierarchal regression approach.

First, the OESP index was regressed on demographic and household characteristics, including age, gender, educational level, employment status, marital status, income level, housing type, home-ownership status, and household size (Model 1). Model 1 explained a significant proportion of variance in overall energy-saving preferences, adjusted $R^2 = 0.26$, $p < .001$. Subsequently, in Model 2, we added a block for attitudinal variables, including general ecological concern and climate change concern. This increased the adjusted R^2 value to 0.34, $p < .001$.

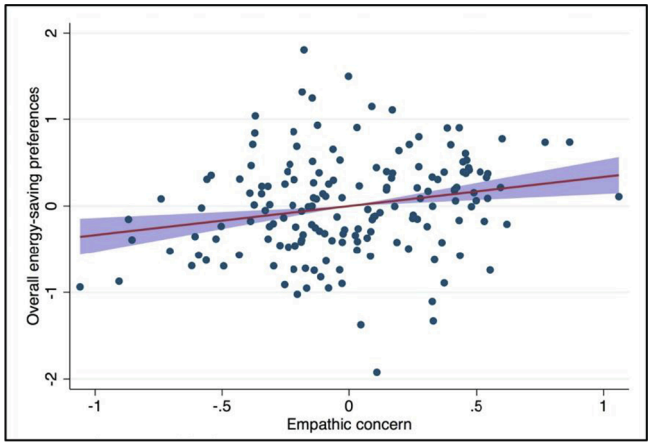

Fig. 1. Empathic concern and overall energy-saving preferences. *Notes:* The figure shows the correlation of empathic concern with overall energy-saving preferences conditional on control variables included in the specification in the main regression model (Table 4). The fitted line is the least-square regression fit with a 95% confidence interval around it.

Finally, the crucial variable of interest - empathic concern- was added in Model 3 (the main model). As expected, higher levels of

empathic concern were associated with higher OESP scores, indicating a stronger preferences for energy-saving behaviour ($b = 0.34$, $t = 3.36$, $p = .001$, 95% $CI = [0.14, 0.53]$). Notably, the effect of empathic concern was significant, even when accounting for other typically important factors. Adding empathic concern improved the model's predictive power and explained about 37% variance in energy-saving preferences. Most importantly, empathic concern explained variation in energy-saving preferences above and beyond the effect of participants' demographic and household characteristics and their general and specific ecological concerns (R^2 change = 0.03). Fig. 1 shows the partial regression plot for the specification in Model 3 (the main model). The correlations appeared to be unaffected by influential outliers.

Though not the main objective of this study, it is interesting to note that age, education, and being a home-owner increased energy-saving preference, whereas residing in private and larger houses had the opposite effect. General ecological concern was also positively associated with energy-saving preferences. Overall, the results indicated that the effect of empathic concern on energy-saving preferences remains significant, even after controlling for socioeconomic factors and attitudinal variables.

4.3.2. Moderation analysis

Since general ecological concern (one of the attitudinal variables added in the regression model) is a domain-general factor, it was important to check whether it moderated the association of empathic concern with energy-saving preferences. The association might be stronger for people with high ecological concerns compared to those with low ecological concerns. A moderation effect may also change the direction of the correlation of interest. We performed a moderation analysis using the procedure described by Aiken and West [64], and Baron and Kenny [65].

We added the two-way interaction term (empathic concern × general ecological concern) in our main regression model (Model 3 in Table 4). A moderation effect would be confirmed if the regression coefficient for the interaction term was significant and if including the interaction term added to the explained variance. The interaction terms was not significant ($b = -0.07$, $t = -0.50$, $p = .621$) and there was no increase in the amount of variance explained ($R^2 = 0.41$, adjusted $R^2 = 0.36$), compared to the main model. We conclude that general ecological concern did not moderate the effect of empathic concern on energy-saving preferences.

4.4. Discussion

Study 1 showed that greater empathic concern is positively and significantly associated with the likelihood of opting for higher energy-savings, supporting our principal hypothesis. Statistically controlling for general demographics, household characteristics, and attitudinal variables did not alter the main findings. Notably, the effect of empathic concern was independent of individuals' level of ecological concerns.

In Study 1, participants made their decision in isolation, making energy-use decisions only for themselves. In line with prevailing theories, it is vital to examine whether the effect of empathic concern will be sustained when there is a conflict with the comfort and welfare of close in-groups. Therefore, in Study 2, we presented the participants with a decision-making scenario in which the decision had consequences for their co-workers.

5. Study 2: deciding for co-workers

In this study, we presented participants with a decision-making scenario identical to the one used in Study 1, with the exception that now they had to make energy-use decisions that affected their co-workers.

Table 5
Items reflecting overall energy-saving preferences (OESP).

Main variables	
	M (*SD*)
Overall energy-saving preferences (Cronbach's alpha = 0.64)	4.94 (0.80)
Reminders for switching off lights in unused office rooms	
Reminders for ensuring electrical appliances not on standby	
Energy-efficient air conditioner unit	
Energy-efficient refrigerator	
Roof insulation	
Window glazing	
CFL/LEDs for office lighting	
Optimum air conditioner temperature	
Optimum use of air-conditioner	
Cut energy-intensive presents such as cut flowers	
Memos encouraging car-pooling and shared taxi rides	
Local work travel by public transport	
Road or train transport for intercity travel during overseas business trips	

Notes: Participants indicated their preferences on a seven-point semantic differential scale where higher values corresponded to the preference for more energy-savings (1 = most energy-intensive option, 7 = most energy-efficient option).

5.1. Participants

The sample consisted of 171 participants (90 men, and 81 women), with a mean age of 37 years ($SD = 9.36$). Compared to Singapore's resident population, the sample included a higher proportion of young people (one-sample test for a difference in proportions: $z = 10.29$, $p < .001$) and people with a high education level ($z = 7.40$, $p < .001$). The proportion of homeowners was slightly lower than in Singapore's resident population ($z = -2.46$, $p = .014$), and the mean household size (3.67) was larger than the national average ($z = 4.38$, $p < .001$). Females, married people, and people from the Malay ethnic group were proportionally represented in the sample ($z = -1.08$, $p = .279$; $z = -0.38$, $p = .704$; $z = -0.43$, $p = .667$, respectively). The proportion of people living in public housings was also similar to the national mean ($z = -0.11$, $p = .914$). See Table 1 for demographic details. A small minority of participants (around 4%) did not answer some questions. Item non-response will impact the number of observations reported for different analyses.

5.2. Decision scenario and measures

As in study 1, we asked participants to indicate their energy-use preferences in the following scenario (differences from the first scenario are underscored):

> *"Suppose that you are at a higher management position in a company where you have to work with the facilities and procurement team to ensure a suitable and comfortable work environment in the company. In this role, you are in command of making all the company decisions related to procurement and fleet, facilities, hospitality, and travel. Keeping this in your mind, please answer the following questions."*

The scenario stated clearly and explicitly that the comfort of employees is a priority. This was to avoid participants prioritizing energy-saving behavior for financial reasons or the sake of corporate responsibility.

Overall energy-saving preferences. We modified the energy-saving behavior questionnaire to reflect the specific scenario and to ensure that the decisions had an impact on everyone in the organization. The

Table 6
Zero-order correlations: Overall energy-saving preferences (OESP), empathic concern, and control variables.

	OESP	Empathic concern	General ecological concern	Climate change concern
OESP	1.00			
Empathic concern	0.18*	1.00		
Age	0.04	0.21**	−0.06	−0.17*
Gender	−0.17*	−0.01	−0.16*	−0.09
Education level	0.11	−0.07	0.21**	0.06
Employment	0.05	−0.13	0.08	0.12
Marital status	0.06	−0.05	0.04	0.06
Income level	0.07	−0.04	0.18*	−0.08
Housing type	−0.09	−0.04	−0.06	−0.15*
Home-ownership status	−0.01	−0.02	0.08	−0.05
Household size	0.11	0.03	−0.04	−0.03
General ecological concern	0.17*	0.15	1.00	0.51***
Climate change concern	0.26***	0.07	0.51***	1.00

questionnaire included thirteen energy-use measures relevant to an office setting. Participants indicated their preferences on a seven-point semantic differential scale, where higher values corresponded to a preference for greater energy-saving (1 = most energy-intensive option, 7 = most energy-efficient option).

We omitted three questions, i.e., optimal air conditioning use, cutting energy-intensive presents, and intercity road and rail transport during overseas business trips. A comparatively high number of participants chose a neutral response (15 to 40%) for these three questions, and all three questions correlated poorly with other energy-saving behaviors. Nonetheless, as these three questions are important to understand participants' tendency towards behavior change and shifting consumption on behalf of their co-workers, we analyzed these variables separately. The remaining ten items formed a scale with acceptable reliability (Cronbach's alpha = 0.64). We computed mean scores across all items (see Table 5 for items), generating the relevant OESP index (M = 4.94, SD = 0.80).

Empathic concern. Empathic concern was measured with the same scale as in Study 1. The reliability of the scale was satisfactory (Cronbach's alpha = 0.67).

Control variables. All control variables were measured exactly in the same manner as in Study 1. The reliability of the general ecological concern scale was satisfactory (Cronbach's alpha = 0.65).

5.3. Results

5.3.1. Zero-order correlations and linear regression analysis

We conducted the same analysis as in Study 1. Participants with greater empathic concern opted for energy-saving behaviors, overriding empathy for their co-workers even when participants were explicitly informed that employees' comfort was an organizational priority. First, the zero-order correlations confirmed that greater empathic concern

Table 7
Regressions of overall energy-saving preferences (OESP) on empathic concern.

	Model (1)				Model (2)				Model (3): Main model			
Dependent variable = OESP	*b* (*SE*)	*β*	*t*	*p*	*b* (*SE*)	*β*	*t*	*p*	*b* (*SE*)	*β*	*t*	*p*
Demographic characteristics												
Age	0.00 (0.01)	0.02	0.30	0.761	0.01 (0.01)	0.06	0.71	0.477	0.00 (0.01)	0.01	0.14	0.889
Gender	−0.27 (0.14)	−0.17	−1.99	0.048	−0.23 (0.14)	−0.14	−1.67	0.098	−0.24 (0.13)	−0.15	−1.81	0.073
Education level	0.07 (0.09)	0.09	0.76	0.449	0.04 (0.09)	0.05	0.41	0.679	0.04 (0.09)	0.05	0.47	0.639
Employment	−0.05 (0.22)	−0.02	−0.24	0.808	−0.05 (0.22)	−0.02	−0.23	0.820	−0.03 (0.23)	−0.01	−0.12	0.905
Marital status	0.04 (0.13)	0.03	0.31	0.756	0.01 (0.13)	0.01	0.10	0.919	0.05 (0.13)	0.03	0.40	0.692
Income level	0.11 (0.11)	0.10	1.09	0.278	0.16 (0.11)	0.14	1.42	0.157	0.16 (0.12)	0.14	1.42	0.158
Housing type	−0.11 (0.05)	−0.17	−2.17	0.032	−0.09 (0.05)	−0.14	−1.78	0.078	−0.09 (0.05)	−0.13	−1.73	0.086
Home-ownership status	−0.16 (0.21)	−0.07	−0.75	0.455	−0.12 (0.20)	−0.05	−0.58	0.561	−0.13 (0.21)	−0.06	−0.64	0.524
Household size	0.10 (0.05)	0.15	1.84	0.068	0.09 (0.05)	0.15	1.95	0.053	0.08 (0.05)	0.13	1.74	0.084
Attitudinal variables												
General ecological concern					−0.04 (0.15)	−0.02	−0.26	0.795	−0.09 (0.16)	−0.06	−0.60	0.551
Climate change concern					0.36 (0.16)	0.24	2.24	0.027	0.34 (0.16)	0.23	2.15	0.033
Variable of interest												
Empathic concern									0.36 (0.17)	0.18	2.15	0.033
R-squared	0.09				0.13				0.16			
Adjusted *R*-squared	0.03				0.07				0.10			
R-squared change	–				0.04				0.03			
F-stat	2.18				2.50				2.45			
p	0.018				0.005				0.006			
AIC	396.1				391.0				387.4			
No. of observations	164				164				164			

Notes: OESP is an index measuring the overall energy-saving preferences of the participants. It varies continuously, where larger values correspond to higher energy-saving preferences. The empathic concern index varies continuously, where larger values correspond to higher empathic concern. Regression coefficients, both raw (*b*) and standardized (*β*) are reported. Robust standard errors (SE) are also reported.

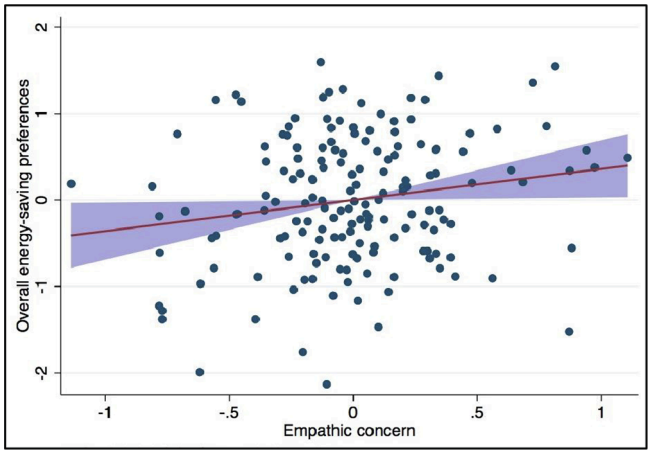

Fig. 2. Empathic concern and overall energy-saving preferences. *Notes:* The figure shows the correlation of empathic concern with overall energy-saving preferences conditional on control variables included in the regression model (main model, Table 7). The fitted line is the least-square regression fit with a 95% confidence interval around it.

was associated with higher OEPS scores, indicating greater energy-saving preferences ($r = 0.18$, $p = .016$, see Table 6 for other correlation coefficients). Regression results (see Table 7) showed that participants with greater empathic concern chose more energy-saving behaviors, even when socioeconomic variables and general and specific ecological concerns were included as control variables ($b = 0.36$, $t = 2.15$, $p = .033$, 95% $CI = [0.03, 0.69]$). The main regression model, which included all variables, explained 10% of the variation in energy-saving preferences.

Crucially, adding empathic concern after controlling for demographic and household characteristics and attitudinal variables improved the predictive power of the regression model (R^2 change = 0.03). Fig. 2 shows the partial regression plot using the estimates reported in the main model of Table 7. The correlations appeared to be unaffected by influential outliers. However, we did not find significant effects for any of the items omitted from the OESP scale (optimal air conditioning use, cutting energy-intensive presents, and intercity road and rail transport during overseas business trips).

Overall, the results indicated that participants with greater empathetic concern systematically opted for higher energy-savings when they were deciding for their co-workers; this held while controlling for demographic and household characteristics as well as general ecological and climate change concerns.

5.3.2. Moderation analysis

General ecological concern did not appear to have a statistically significant association with energy-saving preferences and thus did not warrant a moderation analysis. We conducted a moderation analysis for another attitudinal variable- climate change concern- which did show a statistically significant relationship with energy-saving preferences in this study.

Following the same procedure as in Study 1, we added a two-way interaction term (empathic concern × climate change concern) to the main model specified in Table 7. The interaction term was not significant ($b = 0.03$, $t = 0.11$, $p = .909$) and there was no increase in the amount of variance explained ($R^2 = 0.16$, adjusted $R^2 = 0.09$). We conclude that the climate change concern did not moderate the effect of empathic concern on energy-saving preferences.

5.3.3. Sensitivity to different methods of energy conservation

Since this study focuses on understanding the effect of empathic concern on energy-saving preferences in a scenario where the decision affects co-workers, it might be important to distinguish between energy-conservation methods that impact others directly and those with indirect impact. For instance, energy-efficient purchases (e.g., installing energy-efficient appliances in the office) will not directly impair employees' physical comfort. The impact would mostly be indirect, such as management cutting other employee-focused expenses to offset additional spending on energy-efficient appliances.

Conversely, behavior change measures (e.g., using the optimal temperature setting for air conditioning) would directly impact employees' physical comfort. It is nonetheless important to note that while most energy-efficient appliances have a higher up-front cost, there are long-term savings on bills because electricity usage is reduced. However, these considerations may not affect participants' behavior in this scenario because what matters is not the actual but the perceived impacts on co-occupants of the space (i.e. co-workers).

We checked the sensitivity of our main findings by splitting the overall energy-saving preferences scale into two types of energy-saving measures: those with indirect impact (energy-efficient purchases) and those with direct impact (behavior change measures; see Table A.1 in Appendix A for a full description of the items). The results of the multivariate regression analysis indicated that the impact of empathic concern remains positive and significant for indirect impact measures ($b = 0.41$, $t = 2.04$, $p = .043$), yet this was not the case for direct impact measures ($b = 0.31$, $t = 1.43$, $p = .155$). These results suggest that empathic concern has a more pronounced effect on less intrusive, indirect energy-saving measures than on measures that have a direct, more obtrusive impact.

Interestingly, the results indicated that age could play a role. Older participants were more likely to adopt measures that impact their co-workers indirectly ($b = 0.03$, $t = 2.73$, $p = .007$). In contrast, younger participants ($b = -0.03$, $t = -2.38$, $p = .019$) were more willing to adopt direct approaches that directly affected their co-workers' well-being. As with many similar age-related effects, it is unknown if this is because of maturity or, rather, a generational trend reflecting different values.

5.4. Discussion

The results of Study 2 largely replicated the findings of Study 1. The positive association between empathic concern and overall energy-saving preferences was sustained even when the scenario introduced a conflict between environmental concerns and co-workers' comfort – even though the latter was explicitly identified as a primary concern. A novel observation is that empathic concern appeared to be more critical in the case of energy-saving behaviors that had an indirect impact. In other words, empathic concern seems to influence energy-saving preferences primarily for actions that indirectly affect others.

Overall, the results of Study 1 and Study 2 together indicate that greater empathic concern is associated with a higher likelihood of choosing energy-savings options, regardless of whether individuals make the decisions for themselves or close in-groups. In our final study, we aimed to establish whether the findings of Study 1 and Study 2 change when people make energy-use decisions in a more emotionally complex setting. Thus, in Study 3, we presented participants with a scenario that incorporated possibly the highest emotional conflict: deciding against the comfort of members of their family, such as their children.

6. Study 3: deciding for their family

In Study 3, the decision-making scenario presented to the participants involved making energy-use decisions for their families.

Table 8
Zero-order correlations: Overall energy-saving preferences (OESP), empathic concern, and control variables.

	OESP	Empathic concern	General ecological concern	Climate change concern
OESP	1.00			
Empathic concern	0.30***	1.00		
Age	0.19*	0.05	0.07	−0.01
Gender	0.02	0.14	−0.05	0.05
Education level	0.08	−0.03	0.19**	0.06
Employment	−0.02	−0.20**	−0.07	0.03
Marital status	0.03	−0.01	0.02	−0.01
Income level	−0.04	−0.02	0.01	−0.08
Housing type	−0.03	−0.13	0.05	0.01
Home-ownership status	0.01	−0.12	0.08	−0.13
Household size	0.04	0.13	−0.06	0.08
General ecological concern	0.11	0.32***	1.00	0.40***
Climate change concern	0.26***	0.25***	0.40***	1.00

6.1. Participants

This study included 175 participants aged between 22 and 65 years (96 men and 79 women), with a mean age of 38 years ($SD = 10.02$). The sample included a higher proportion of young people (one-sample test for a difference in proportions: $z = 9.40$, $p < .001$) and people with a high education level ($z = 6.46$, $p < .001$). Women, married people, homeowners, and people living in public housing were proportionally represented in the sample ($z = -1.68$, $p = .092$; $z = 0.34$, $p = .737$; $z = -1.50$, $p = .133$; $z = 0.79$, $p = .429$, respectively). The mean household size (3.43) was a bit larger than the national mean (3.24, $z = 1.96$, $p = .051$). People from the Malay ethnic group were proportionally represented in the sample ($z = -1.20$, $p = .226$). See Table 1 for further details. As was the case in Study 1–2, a small minority of participants (around 2%) failed to complete all questions. Item non-response will impact the number of observations reported for different analyses.

6.2. Decision-making scenario and measures

In Study 3, we presented participants with the following scenario (differences from the original scenario are underscored):

> *"Imagine that you live in a house with your family (spouse, children, and/or parents). As other members of the family are too busy, too young, or too old to decide, you make decisions for all household-related matters, and they always follow it. Keeping this in your mind, please answer the following questions."*

Overall energy-saving preferences. We used the 22-item scale used in Study 1 to measure participants' energy-saving preferences. However, to accommodate the new scenario, the items were rephrased to ensure that decisions impacted everyone in the family (for the exact question

Table 9
Regressions of overall energy-saving preferences (OESP) on empathic concern.

Dependent variable = OESP	Model (1)				Model (2)				Model (3) = Main Model			
	b (*SE*)	*β*	*t*	*p*	*b* (*SE*)	*β*	*t*	*p*	*b* (*SE*)	*β*	*t*	*p*
Demographic characteristics												
Age	0.02 (0.01)	0.26	2.85	0.005	0.01 (0.01)	0.24	2.65	0.009	0.01 (0.01)	0.23	2.61	0.010
Gender	0.07 (0.10)	0.05	0.65	0.520	0.05 (0.10)	0.04	0.50	0.621	0.02 (0.10)	0.02	0.23	0.818
Education level	0.12 (0.06)	0.20	1.91	0.058	0.10 (0.07)	0.17	1.58	0.115	0.11 (0.06)	0.18	1.70	0.090
Employment	−0.01 (0.15)	−0.00	−0.07	0.942	−0.03 (0.14)	−0.01	−0.19	0.850	0.09 (0.13)	0.04	0.69	0.488
Marital status	0.02 (0.10)	0.02	0.20	0.844	0.02 (0.10)	0.01	0.17	0.865	0.03 (0.10)	0.02	0.29	0.770
Income level	−0.11 (0.09)	−0.10	−1.24	0.218	−0.07 (0.08)	−0.06	−0.78	0.435	−0.10 (0.08)	−0.09	−1.14	0.257
Housing type	−0.02 (0.04)	−0.04	−0.47	0.642	−0.03 (0.04)	−0.05	−0.67	0.502	0.00 (0.04)	0.00	0.01	0.988
Home-ownership status	0.04 (0.19)	0.02	0.20	0.845	0.09 (0.18)	0.05	0.50	0.620	0.14 (0.17)	0.07	0.80	0.425
Household size	0.03 (0.04)	0.06	0.74	0.458	0.01 (0.03)	0.03	0.39	0.699	−0.00 (0.03)	−0.00	−0.05	0.963
Attitudinal variables												
General ecological concern					−0.03 (0.11)	−0.02	−0.28	0.783	−0.13 (0.11)	−0.10	−1.17	0.243
Climate change concern					0.30 (0.08)	0.27	3.53	0.001	0.25 (0.08)	0.23	3.11	0.002
Variable of interest												
Empathic concern									0.44 (0.15)	0.28	2.93	0.004
R-squared	0.07				0.13				0.19			
Adjusted *R*-squared	0.02				0.07				0.13			
R-squared change	–				0.05				0.06			
F-stat	1.15				2.70				2.86			
p	0.333				0.003				0.001			
AIC	326.1				317.9				307.5			
No. of observations	171				171				171			

Notes: OESP is an index measuring the overall energy-saving preferences of the participants. It varies continuously, where larger values correspond to higher energy-saving preferences. The empathic concern index varies continuously, where larger values correspond to higher empathic concern. Regression coefficients, both raw (*b*) and standardized (*β*) are reported. Robust standard errors (SE) are also reported.

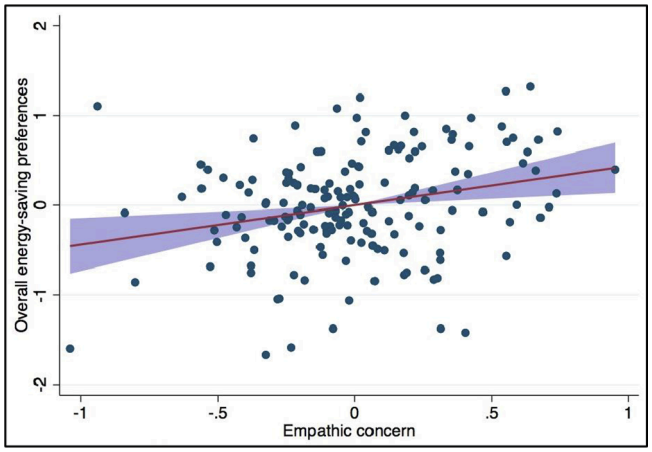

Fig. 3. Empathic concern and overall energy-saving preferences. *Notes:* The figure shows the correlation of empathic concern with overall energy-saving preferences conditional on control variables included in the regression model (main model, Table 9). The fitted line is the least-square regression fit with a 95% confidence interval around it.

wording, see online appendix). We computed the mean score across 22 items, which formed a scale with acceptable reliability (Cronbach's alpha = 0.68), to generate the relevant OESP index ($M = 5.02$, $SD = 0.61$).

Empathic concern. Empathic concern was measured using the same scale as in Study 1 and 2 (Cronbach's alpha = 0.67).

Control variables. All control variables were measured exactly in the same manner as in Study 1 and 2. Reliability of the general ecological concern scale was satisfactory (Cronbach's alpha = 0.68).

6.3. Results

6.3.1. Zero-order correlations and linear regression analysis

Even in this emotionally conflicting scenario, energy-saving preferences were more pronounced among participants with greater empathic concern. First, the zero-order correlations indicated that greater empathic concern was associated with a higher score on the OESP scale, indicating stronger energy-saving preferences ($r = 0.30$, $p < .001$, see Table 8 for other correlations). The regression analyses indicated that participants with greater empathic concern were more likely to opt for higher energy-savings ($b = 0.44$, $t = 2.93$, $p = .004$, 95% $CI = [0.14, 0.73]$), even when accounting for their demographic and household characteristics and general and specific ecological concerns (see Table 9).

Our main regression model explained approximately 13% of the variation in energy-saving preferences. Crucially, the hierarchical regression approach showed that adding empathic concern significantly improved the predictive power of the regression model that included the control variables (R^2 change = 0.06). Empathic concern explained variation in overall energy-saving preferences above and beyond the effect of socioeconomic factors and attitudinal variables. Moreover, as depicted in Fig. 3, the estimated regression results do not appear to be driven by outliers. Additionally, we note that energy-saving preferences increased with age and climate change concerns.

Overall, the results indicate that participants with greater empathic concern systematically chose more energy-savings options when asked to decide for their families; as before, this held when controlling for their demographic and household characteristics as well the general ecological and climate change concerns.

6.3.2. Moderation analysis

Similar to findings in study 2, general ecological concern was not significantly associated with energy-saving preferences. We conducted a moderation analysis for climate change concern, which did have a statistically robust relationship with energy-saving preferences. Following the same procedure as in Study 1–2, we added the two-way interaction term (empathic concern × climate change concern) to the main model. The interaction term was not significant ($b = -0.001$, $t = -0.00$, $p = .997$). Again, there was no increase in the variance explained ($R^2 = 0.19$, adjusted $R^2 = 0.13$). We conclude that climate change concern did not moderate the effect of empathic concern on energy-saving preferences.

6.3.3. Sensitivity to different methods of energy conservation

As in study 2, we verified the sensitivity of our main findings by examining energy-savings measures with direct impact (energy-efficient purchase) and indirect impact (behavior change and shift in consumption; see Table A.1 in Appendix A for a description of the items). The multivariate regression analysis revealed a significant effect of empathic concern on both outcome variables (F (2, 158) = 7.09, $p = .001$).

Empathic concern was positively and significantly associated with indirect impact measures ($b = 0.73$, $t = 3.66$, $p < .001$). We found a similar effect for direct impact measures ($b = 0.30$, $t = 2.39$, $p = .018$). Overall, it shows that participants with greater empathic concern chose more energy-saving options irrespective of whether the measures impacted their family directly or indirectly.

6.4. Discussion

Study 3 largely replicated the findings of Study 1 and Study 2, supporting the hypothesis that empathic concern is positively associated with overall energy-saving behavior. A crucial observation in Study 3 was that empathic concern significantly influenced energy-saving behavior, regardless of whether the energy-saving measures had a direct or indirect impact on family members. Together, these studies suggest that the association of empathic concern with energy-saving behavior overrides organizational priorities, close in-group cooperation, family relationships, and preferences to ensure the immediate comfort of kin-members.

7. General discussion

7.1. Main findings

As aggregate household energy consumption continues to grow, residential energy conservation has become an essential mechanism for reducing anthropogenic greenhouse gas emissions, addressing climate change, and achieving a sustainable future. Forming a comprehensive understanding of the full spectrum of the motives underlying energy-saving decisions is a critical part of that process.

There is a multitude of possible reasons why people make energy-saving or energy-intensive choices. Our objective in this paper was to investigate the role of empathic concern – a predisposition that not only helps people understand others' feelings but also drives them to act in the interest of others – in shaping energy-saving behavior.

In all three studies, we found that greater empathic concern was associated with a more pronounced tendency to choose energy-saving options. This effect remained prominent, even after controlling for socioeconomic characteristics and attitudinal variables. We explored the potential heterogeneity of this relationship in boundary conditions, i.e. when participants had to account for the needs of either a close in-group with high synergistic features (co-workers) or a group of people that

would be expected to elicit a conflicting and strong empathic response involving their immediate comfort (family).

Most importantly, as hypothesized and in contrast to what previous literature has suggested, our findings show that the empathic concern is positively and robustly related to energy-saving preferences across different relationship contexts. We consistently found that individuals' energy-saving preferences were positively associated with their level of empathic concern, irrespective of whether they were deciding for themselves, a close in-group (co-workers), or their kin (family). The findings indicated that the tendency to feel, care, and act for ensuring the global and long-term welfare of others (all of humanity, in this case) overrode the need to ensure the immediate and local comfort of one's in-group and kin.

In the introduction, we discussed the phenomenon that empathic concern can sometimes be avoided when perceived as materially or cognitively taxing. It is unknown whether the perceived cognitive or material costs of the energy-saving behaviors influenced our studies. Future studies could explicitly address this issue by manipulating the various costs of environmental actions and then evaluate whether empathic concern differentially impacts individual preferences for such actions. Even if the cognitive demands associated with energy-saving behavior present a barrier, the existing literature provides useful suggestions for interventions to overcome this.

For instance, Cameron et al. [35] demonstrated that people systematically avoided feeling empathic towards strangers. Yet, empathy avoidance could be mitigated by experimentally enhancing perceived efficacy (believing in one's ability to understand others' feelings). Thus, the cognitively taxing act of empathizing with others is initiated when empathic actions are rewarding (e.g. when they benefit kin), and when more meaning and commitments are associated with it.

Similarly, as discussed in the introduction, a small number of studies have shown that empathy towards the environment is related to pro-environmental behavior (e.g., [42–45]). This mechanism could explain the present results: empathy towards the environment eclipsing empathy towards fellow humans. One alternative interpretation might be that people with greater empathic concern emphasize the long-term benefits for humanity in their energy-use choices. Our findings nevertheless advance the literature in understanding the role of empathic concern in energy-saving behavior. Future studies should aim to elucidate which (or both) of these empathic orientations drives energy-saving behavior in highly empathic individuals.

Our findings on energy-saving preferences in boundary conditions, i.e. when energy-use decisions affect co-workers and family, can also be explained by existing studies that suggest a broad set of norms and moral obligations govern decisions to help family members [66,40]. Thus, the choice to ensure immediate comfort of close in-groups or kin over the long-term collective consequences for all fellow humans could be explained by moral obligation rather than empathic concern. Conversely, the empathy-altruism hypothesis of Batson et al. [20,21] suggests that empathic concern is elicited by the perceived welfare of others and produces motivation with the ultimate goal of increasing that welfare (altruistic motivations). Our findings are consistent with an interpretation in-line with the empathy-altruism hypothesis of Batson et al. [20,21].

We noted a qualitative difference between energy-saving behaviors that affect others' needs (mainly close in-groups). Some measures directly impact others (behavior changes such as choosing the optimal air conditioning temperature setting) while other measures have indirect effects (such as energy-efficient purchases). Our analysis suggests that empathic concern seems to preferentially be expressed by adopting measures that do not require a behavior change or cause direct discomfort to co-workers.

However, the effect of empathic concern was pronounced for both types of measures (direct and indirect) when people made energy choices for their immediate kin (family). Making energy-choices for co-workers may involve a comparatively higher level of decision uncertainty and inefficacy as is highlighted by the existing literature (see, e.g., Cameron et al. [35]). This may, in turn, promote more conservative decision making.

Empathic concern explains equivalent or even more variance in energy-saving choices than the 'traditional' predictors do, suggesting that empathic concern is not only a significant but also an independent factor in pro-environmental decision making. Previous research in environmental psychology has highlighted the critical role of attitudes, subjective norms, social motives, and personal norms in explaining pro-environmental behavior [9,10,12,13,67,68]. Additionally, energy and environmental research have uncovered many other variables influencing individuals' decisions to adopt clean energy technologies. These include age, education, income, financial incentives, and public awareness [7,69,60,70].

Our study confirms the relevance of some of socioeconomic characteristics and pro-environmental values and beliefs. However, empathic concern has emerged as a crucial and novel addition to that list. Therefore, our study adds to the existing models that suggest people tend to save energy to either save money [8] or feel good about themselves [14]. The results indicated that tendency to feel, care, and act in the interest of others could be associated with energy-saving choices.

Our findings, we believe, are noteworthy for the theory of empathy. It introduces the possibility that empathic concern could also be directed to longer-term, broadly distributed benefits and that it is not restricted to actions direct at one's kin. To some extent, these findings challenge the current evolutionary understanding of empathy as a mere carrier of cooperative needs and offer a more optimistic view of empathy as a driver of change.

7.2. Limitations and future research directions

All three studies report on data obtained from residents of Singapore. As a future-oriented, multicultural city-nation and one of the biggest financial hubs in Asia and globally, Singapore has some unique aspects that make these results very informative. The territory of Singapore includes one main island, sixty-three satellite islands and islets, and one outlying islet with a total population of approximately 5.70 million people on a total area of around 724 square km. These specific circumstances, particularly Singapore's space constraints, natural and renewable resource scarcity, ambitious global commitments to reduce greenhouse gas emissions and ensure sustainable economic growth, have led to a strong focus on energy-conservation and various environmental awareness programs for its citizen.

For instance, the National Environment Agency (NEA) of Singapore has, for many years, been promoting energy efficiency in industries, households, and public sectors through legislation, incentives, and public education. A well-connected, most affordable, and world-class public transport system is another unique feature of the country [71]. Singapore has recently substantially increased the share of cleaner fuels for electricity generation. The country presently uses around 80% of natural gas for electricity generation, as compared to 19% in the year 2000 [72].

As the government and the population alike have actively elevated energy-saving behavior to the level of national importance, in many respects, Singapore's energy and environmental context are both regionally and globally unique. Although future studies would need to examine the generalizability of the present findings [73], it can be argued that, given all these unique characteristics, Singapore offers a 'glimpse into the future' and could act as an early test-bed for various policies.

Although we strived to recruit a representative sample of the resident population in Singapore, there are some notable differences. Specifically, all three samples included a higher proportion of people with a university degree, and women were underrepresented in one study.

Furthermore, the study design for measuring energy-saving preferences and empathic concern was correlational. Conclusions about the

causality of this relationship are, therefore, premature. However, given that empathic concern is arguably a trait that develops early, the most likely causal chain is one where personality characteristics influence energy-saving behavior rather than the other way around. However, the possibility of interacting or mutually reinforcing effects cannot be excluded. For instance, the perceived need to protect the environment might promote particular personality characteristics. The possibility of omitted variable bias should be ruled out before any strong causal statements can be made. Future research could focus on establishing causality through experimental design.

We used a stated preference experiment to assess participants' energy-use behavior and did not measure their actual energy consumption. However, the results of our study could nevertheless reflect actual energy-use behavior. First, social psychological research has repeatedly found that intentions and attitudes shape behavior [19,74]. Second, there is good evidence that hypothetical choices match real choices [75,76]. Yet, the latest studies (see, e.g., [77,78]) indicate that while self-reported and objective measures of pro-environmental behavior largely match, the validity of self-assessments might still be questionable.

For instance, Lange and Dewitte [77] recommend using other methods alongside self-reports to measure pro-environmental behavior. Adding laboratory tests and field recordings as robustness checks are some of the recommended methods. Future research should include objective measures of energy-saving behavior to establish a stronger evidence base on the effect of empathic concern on energy-saving behavior.

Similarly, we tested our hypothesis using three different real-life scenarios in three separate studies [79]. An alternative could be to adopt a within-participants design, where all participants would be presented with all three scenarios. While this reduces inter-individual variability, it could introduce other unwanted confounds. For instance, answers in one domain could influence the participants' responses in another. Repeated exposure to the paradigm could make the objective of the study too apparent to the participants. The main problem is that many energy-saving behaviors are specific to the context (e.g. office/co-workers vs. home/family).

We controlled for general demographics and specific household features to account for the potential influence the overall experiences and background of the participant could have on their energy-saving preferences. Furthermore, the energy-saving questionnaire was modified to reflect the specifics of each decision scenario (see the online appendix for full wording of the questions). Nonetheless, future research might offer the opportunity to develop this paradigm further. This could include manipulation checks and explicit questions about the participant's personal experience with energy-efficient practices.

Finally, to ensure that our findings were not affected by other domain-general factors, we conducted moderation analyses with attitudinal variables i.e. ecological concerns. Results suggested that there was no moderation involved. Yet, many other factors (e.g., connectedness with nature [80]) could moderate the effect of interest. Future research should include these metrics.

7.3. Practical implications

Government authorities, policymakers, and social marketers aiming to understand, and influence people's energy choices might benefit from the present findings by considering the empathic conflicts that consumers might experience. While it might be arduous or expensive to directly gather data on consumers' personality traits, big data and social media analyses could potentially offer additional mechanisms for obtaining rich consumer insights [81]. Furthermore, previous research in psychology has demonstrated that empathic concern can be induced ("primed") [82], which opens up the possibility of testing and implementing targeted social marketing, as has already been done in other domains [83].

In sum, in addition to the conventional mechanisms such as financial incentives, legislations, and technological improvements, another factor associated with human motivation – the feeling of warmth, compassion, and concern for others – offers a new tool for enhancing energy efficiency in the residential sector.

8. Ethics statement

Informed consent was obtained from all the survey participants, the anonymity of the participants was ensured and collected data is kept confidential. Before starting the study, the Institutional Review Board of NTU (the central ethics committee) reviewed and approved our study procedures.

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Author contributions

Georgios Christopoulos and Swati Sharma designed the research study. Swati Sharma carried out data collection and analyzed the data. Georgios Christopoulos and Swati Sharma wrote the manuscript.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A

Table A.1
Items representing direct and indirect impact energy-saving measures.

Study 2	
Indirect impact measures (Energy-efficient purchases)	Air conditioner, refrigerator, roof insulation, window glazing, and energy-efficient lightings
Direct impact measures (Behavior change)	Switching off lights, electrical appliances not on stand-by, the optimum temperature for air conditioner, car-pooling, and shared taxi, and public transport for local work travel.
Study 3	
Indirect impact measures (Energy-efficient purchases)	Air conditioner, refrigerator, washing machine, home lightings, fuel-efficient car, electric car, and Econometer
Direct impact measures (Behavior change and shifting in consumption patterns)	Switching off lights, electrical appliances not on stand-by, laundry drying, reduced shower time, the optimum temperature for air conditioner, minimal use of air-conditioner, dish cleaning, walking a short distance, walking medium distance, using public transport and car-pooling, and shared taxi, buying regionally grown vegetables, cut energy-intensive presents, using public transport during overseas holidays, and intercity travel by rail or road transport during overseas holidays

Notes: See Table 5 and the online appendix for the full wording of items.

Appendix B. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.erss.2020.101879.

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