frontiers | Frontiers in Environmental Science

TYPE Brief Research Report
PUBLISHED 06 February 2024
DOI 10.3389/fenvs.2024.1354677

OPEN ACCESS

EDITED BY
Athanasios Angelis-Dimakis,
University of Huddersfield, United Kingdom

REVIEWED BY
Theo Lieven,
University of St. Gallen, Switzerland
Alexandru Maxim,
Alexandru Ioan Cuza University, Romania

*CORRESPONDENCE
Stav Rosenzweig,
stavro@bgu.ac.il

RECEIVED 12 December 2023
ACCEPTED 22 January 2024
PUBLISHED 06 February 2024

CITATION
Scarlat G, Rosenzweig S and Rubin O (2024), Which energy labels should we use to expedite the transition to electric vehicles?
Front. Environ. Sci. 12:1354677.
doi: 10.3389/fenvs.2024.1354677

Which energy labels should we use to expedite the transition to electric vehicles?

Gal Scarlat[1], Stav Rosenzweig[2,3]* and Ofir Rubin[3,4]

[1]The Department of Business Administration, The Guilford Glazer Faculty of Business and Management, Ben-Gurion University of the Negev, Beer Sheva, Israel, [2]The Department of Management, The Guilford Glazer Faculty of Business and Management, Ben-Gurion University of the Negev, Beer Sheva, Israel, [3]The Goldman Sonnenfeldt School of Sustainability and Climate Change, Ben-Gurion University of the Negev, Beer Sheva, Israel, [4]The Department of Public Policy and Management, The Guilford Glazer Faculty of Business and Management, Ben-Gurion University of the Negev, Beer Sheva, Israel

In recent years, numerous countries have enacted legislation to halt fossil-fueled vehicle sales within five to 10 years. With shrinking global markets for these vehicles, manufacturers are increasingly motivated to redirect them towards nations with less stringent regulations, using attractive prices and other tactics. However, the sale of new fossil-fueled vehicles poses a public challenge as they will remain in use for years. Consequently, reducing the likelihood of consumers purchasing new fossil-fueled vehicles in favor of electric vehicles is crucial in all countries, particularly those with less stringent regulations, to meet emission goals. Efforts to promote electric vehicle adoption through policy measures fall short due to underestimated cognitive biases and consumer behavior impacts. We contribute to the literature by bridging the gap between human behavioral studies and environmental policy. We incorporate choice architecture into energy labels to determine which information architecture regarding energy costs is an effective nudge in increasing electric vehicle purchase intentions. Our experiment finds that labels framing energy costs as 'expenditure,' rather than 'savings,' are more effective in increasing the intent to purchase an electric vehicle. Additionally, we find that a graphical display of expenditure was not effective in influencing purchase intentions. Policymakers can use similar choice architecture tools to encourage electric vehicle adoption, expediting the transition to electric vehicles and achieving national environmental goals.

KEYWORDS

electric vehicle (EV), energy label, nudge, choice architecture, consumer behavior, public policy

1 Introduction

In recent years, many countries have adopted the Corporate Average Fuel Economy (CAFE) regulations or CAFE-like standards, which require automobile manufacturers to comply with energy and/or environmental quality standards for the vehicles they market (IEA, 2023b). Given the severity of the climate crisis and the fact that not all countries have embraced these regulations, supplementary actions seem necessary. Consequently, numerous countries have enacted legislation establishing an absolute cessation of fossil-fueled vehicle sales within five to 10 years. For example, the United Kingdom, Singapore, Netherlands, Ireland, Austria, and Ukraine declared either zero-emission vehicle sales or 100% electric vehicle (EV) sales by 2030, whereas Norway pledged to meet these standards as early as 2025, and Denmark has committed to allowing only zero-emission public bus sales by 2025 as well (IEA, 2023a). A complete global cessation of the marketing and production of fossil-fueled vehicles and an immediate transition to alternative propulsion systems are, however, unrealistic and require substantial efforts and resources. As a result, automobile manufacturers are highly motivated to redirect their current fossil-fueled vehicles to countries with less stringent regulations. With shrinking markets for polluting vehicles, manufacturers will inevitably shift their marketing efforts to those markets with more lenient regulations. Moreover, they will likely employ attractive prices and other tactics to reduce inventory and maximize sales of existing car models.

The current study was conducted in a country with no CAFE-like regulations, due to the absence of a local automobile industry. Nevertheless, this case holds relevance for any country with limited CAFE-like regulations as it illuminates the dynamics that surface when environmental standards in the car market are low. This situation might appeal to global manufacturers, incentivizing them to exploit these markets by targeting them with their polluting vehicle models.

In accordance with the global trend, Israel's Ministry of Energy published its 2030 vision, where any new fossil-fueled vehicle sales will be discontinued, in favor of a complete transition to electric and compressed natural gas (CNG) propulsion. Although this vision was made public in 2018, approximately 89% of vehicles in Israel still run on gasoline or diesel. Moreover, numerous polluting vehicle models that are no longer allowed in countries with strict emissions regulations could still enter Israel before the 2030 deadline. Any fossil-fueled vehicles entering Israeli ports will likely be used for several years (the average age of Israeli vehicles in 2022 was 7.4 years (CBS, 2022)). Therefore, a policy that reduces the sales of these vehicles before import restrictions take effect is imperative. The present study examines the impact of several versions of information architecture in energy labels on consumer preferences for EVs over fossil-fueled vehicles.

2 Literature review

2.1 Drivers and barriers of EV adoption

Despite energy-efficient technologies such as EVs having lower operational costs, the potential for long-term cost savings, and environmental benefits, some consumers are hesitant to purchase these technologies due to their high purchase price, among other reasons (Dumortier et al., 2015). Recent studies have investigated ways to encourage consumers to purchase EVs. One research stream examined how EVs technical characteristics, such as driving range, purchase costs, and environmental performance influence adoption decisions (Barth et al., 2016; Mohamed et al., 2016; Degirmenci et al., 2017; Orlov and Kallbekken, 2019). A second research stream examined the impact of policy incentives on EV adoption, categorizing them into financial and non-financial incentives (Huang and Qian, 2018; Zou et al., 2019; Li et al., 2020; Ye et al., 2021). Some studies found that the key catalyst for EV adoption are financial incentives, which can take the form of purchase subsidies, tax exemptions, road toll waivers, and parking fee reductions (Aasness and Odeck, 2015; Ye et al., 2021). Other studies emphasized the effect of non-financial incentives. For example, several studies suggested that designated free parking and permission to use public transport lanes were very effective in persuading consumers to purchase EVs (Bjerkan et al., 2016; Langbroek et al., 2016). Yet other studies pointed at the importance of the removal of barriers related to the adoption of new technology (such as charging time, charging station availability, driving range, affordability, knowledge, perceived safety, and more (Krause et al., 2016; She et al., 2017; Tarei et al., 2021)).

2.2 Choice architecture and nudges

Consumers' judgment and decision-making regarding high-involvement purchases are executed through complex cognitive processes, some of which are rational, and some are not. In many cases, information is either unavailable or not readily accessible, making the decision-making process neither straightforward nor fully informed (Mertens et al., 2022). Consequently, most decisions are influenced by cognitive biases, and the decision-making process can be highly sensitive to influence. One way to impact the decision-making process is the use of nudges (Payne et al., 1992; Lichtenstein and Slovic, 2006; Gigerenzer and Gaissmaier, 2011). A nudge is an intervention from the field of behavioral economics that guides consumers toward desirable patterns of behavior through specific interventions while preserving their freedom of choice (Thaler et al., 2009). Nudges can operate, among other means, through the design of choice architecture, altering how information is presented or framed, such as displaying energy labels on products (Hille et al., 2018). Exposure to labels with energy information is expected to lead to more informed purchase decisions, and prior research has found that it could encourage choosing energy-efficient products (Mertens et al., 2022). Therefore, the design of energy labels for vehicles can be effective in promoting the choice of EVs over fossil-fuel vehicles. Specifically, the present research examines the presentation of energy information on labels as "expenditure," "savings," and the effectiveness of graphical presentation.

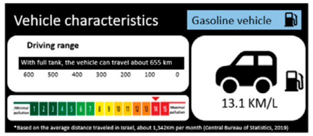
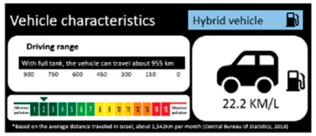
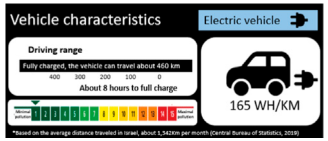
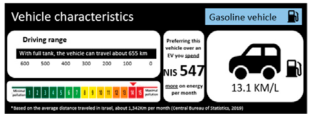
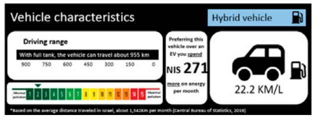
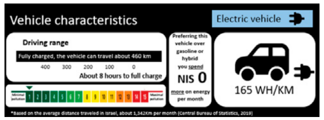
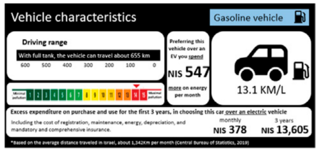
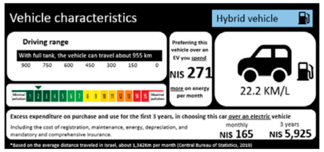
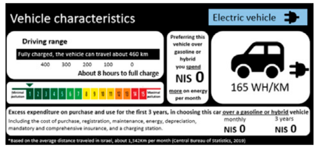
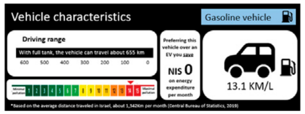
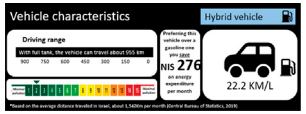
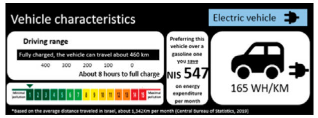
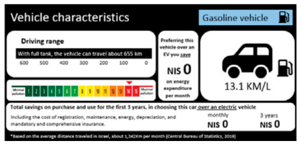
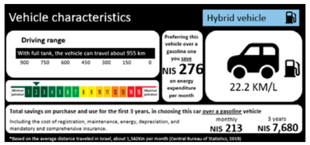
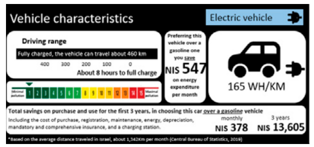
2.3 Energy labels and consumer choice

Several studies have examined the impact on consumer behavior of energy labels on non-automotive products. An early study used the Energy Policy and Conservation Act (EPCA) implemented in the USA in 1975 to investigate how energy labels affect consumers' choice of household electrical devices. The researchers found that labels providing information about energy consumption communicate information that consumers perceive as useful, however they do not meaningfully affect consumers' decisions to purchase energy-efficient products (McNeill et al., 1979). Later studies found that the European Union energy labels led consumers to read energy consumption data and increased consumers' awareness of environmental considerations when purchasing energy-consuming products (Waechter et al., 2015), but also led consumers to buy larger refrigerators compared to refrigerators without energy-related labels (Stadelmann and Schubert, 2018).

Regarding energy labels specifically of EVs, information about the total cost of ownership was found to be more influential on consumer perceptions of EVs than information about fuel savings (Dumortier et al., 2015). A more recent study found that

10.3389/fenvs.2024.1354677

TABLE 1 Experiment conditions and information included in the energy labels[a] (expenditure and savings are in New Israeli Shekels [ILS][b]) (See larger images of the labels in the supplementary images to this manuscript).

	Information included in label[c]		
Condition	**Gasoline vehicle**	**Hybrid vehicle**	**Electric vehicle**
Control group (Fig. A1)	Basic information (kilometers per liter, driving range, pollution level) 	Basic information (kilometers per liter, driving range, pollution level) 	Basic information (watt-hour/kilometer, driving range, time to full charging, pollution level) 
Condition 1 **Monthly expenditure** (Fig. A2)	Basic information + monthly energy expenditure compared to an EV in the category 	Basic information + monthly energy expenditure compared to an EV in the category 	Basic information + monthly energy expenditure compared to a gasoline or hybrid in the category 
Condition 2 **Three-year expenditure** (Fig. A3)	Basic information + monthly energy expenditure + total expenditure over first 3 years compared to an EV in the category 	Basic information + monthly energy expenditure + total expenditure over first 3 years compared to an EV in the category 	Basic information + monthly energy expenditure + total expenditure over first 3 years compared to a gasoline or hybrid in the category 
Condition 3 **Monthly savings** (Fig. A4)	Basic information + monthly energy savings compared to an EV in the category 	Basic information + monthly energy savings compared to a gasoline vehicle in the category 	Basic information + monthly energy savings compared to a gasoline vehicle in the category 
Condition 4 **Three-year savings** (Fig. A5)	Basic information + monthly energy savings + total savings over first 3 years compared to an EV in the category 	Basic information + monthly energy savings + total savings over first 3 years compared to a gasoline vehicle in the category 	Basic information + monthly energy savings + total savings over first 3 years compared to a gasoline vehicle in the category 

(Continued on following page)

10.3389/fenvs.2024.1354677

TABLE 1 (*Continued*) Experiment conditions and information included in the energy labels[a] (expenditure and savings are in New Israeli Shekels [ILS][b]) (See larger images of the labels in the supplementary images to this manuscript).

Condition	Information included in label[c]		
	Gasoline vehicle	Hybrid vehicle	Electric vehicle
Condition 5 **Graphical display of expenditure** (Fig. A6)	Graphical comparison of expenditure components between the types of vehicle: purchase cost, insurance, depreciation, energy costs, taxes, maintenance costs, and charging station installation costs over the first 3 years		
			

[a]The total expenditure for the first 3 years included purchase cost, tax, maintenance cost (services), energy expenditure (gasoline/electricity), car insurance, depreciation, and charging station installation cost.
[b]ILS, 1 ≈ $0.3.
[c]Basic information includes energy efficiency, driving range, charging time, and pollution level.

emphasizing future savings had a positive impact on consumers' willingness to purchase EVs (DellaValle and Zubaryeva, 2019).

Policy measures aimed at promoting EV adoption are still far from fully realizing their potential because they underestimate cognitive biases and behavioral differences among consumers (Green et al., 2014; DellaValle and Zubaryeva, 2019). The present study aims to bridge this gap.

3 Method

Our research approach and study design follow previous studies that use concepts of energy labels. Waechter et al. (Waechter et al., 2015) conducted a choice experiment with EU energy labels and used an eye-tracking approach and Stadelmann and Schubert (Stadelmann and Schubert, 2018) conducted a field experiment using an online appliances retailer. Both studies used energy labels as stimuli and examined the effect of their design and content on consumer choice in the context of home appliances. Hille et al. (Hille et al., 2018) examined energy labels with emission information in the automobile market and the effect of information in absolute terms vs. information relative to other vehicles in the same class. Of particular relevance to our study are the following two studies. DellaValle and Zubaryeva (DellaValle and Zubaryeva, 2019) examined the preference for EVs when displaying information regarding future savings. Finally, Dumortier et al. (Dumortier et al., 2015) examined the effect of energy labels on preference for gasoline, hybrid, and battery electric vehicles.

Following the two latter studies, the present research was conducted through an online experiment during April 2023. The experiment was executed by a market research firm with 1,374 participants representing the Israeli population, who held valid driver's license.[1] Two weeks before the experiment, participants were asked to declare their willingness to adopt an EV on a scale of 1–5 (1 = no chance, 5 = definitely will purchase). During the experiment, participants were randomly assigned to one of six groups (five conditions and one control group, as detailed in Table 1), with each group exposed to a unique set of energy labels. To fit the Israeli market and the aims of the present study, we adapted the basic label structure from Dumortier et al. (Dumortier et al., 2015) and the graphical display of expenditure from DellaValle and Zubaryeva (DellaValle and Zubaryeva, 2019) (see Table 1). Each set included labels for a gasoline, a hybrid, and an electric vehicle. The information displayed on the labels was real information that pertained to the best-selling vehicles in Israel in 2022, as reported in formal publications by the Israel Central Bureau of Statistics and in local media (CBS, 2022; Goren, 2023), as follows. Gasoline vehicle information refers to Kia Seltos EX, hybrid vehicle information refers to Toyota Corolla Sedan Sense, and EV information refers to Geely Geometry C Pro 460. All three vehicles belong to the compact or family compact SUV category, sharing similar technical characteristics and appearance. The presented prices were market prices during the experiment. Parameters on the labels (driving

1 The experiment was preregistered at AsPredicted; preregistration is available upon request

TABLE 2 Correlation matrix for the study's variables.

	Mean	1	2	3	4	5	6	7	8
1. EV purchase intentions before exposure to energy labels	3.09	1	0.637**	0.123**	0.099**	0.119**	0.039	0.045	0.134**
2. Purchase intentions following exposure to labels	3.10	0.637**	1	0.165**	0.060*	0.106**	0.070*	0.059*	0.131**
3. Experience with EV	0.04	0.123**	0.165**	1	0.109**	0.031	0.049	0.003	0.035
4. Experience with hybrid/plug-in hybrid	0.17	0.099**	0.060*	0.109**	1	0.016	0.140**	−0.039	0.032
5. Gender (male = 1)	0.47	0.119**	0.106**	0.031	0.016	1	−0.035	−0.020	0.111**
6. Number of vehicles in household	1.71	0.039	0.070*	0.049	0.140**	−0.035	1	−0.003	0.008
7. Children in household (1/0)	0.55	0.045	0.059*	0.003	−0.039	−0.020	−0.003	1	0.327**
8. Spouse (1/0)	0.73	0.134**	0.131**	0.035	0.032	0.111**	0.008	0.327**	1

*$p < 0.05$, **$p < 0.01$.

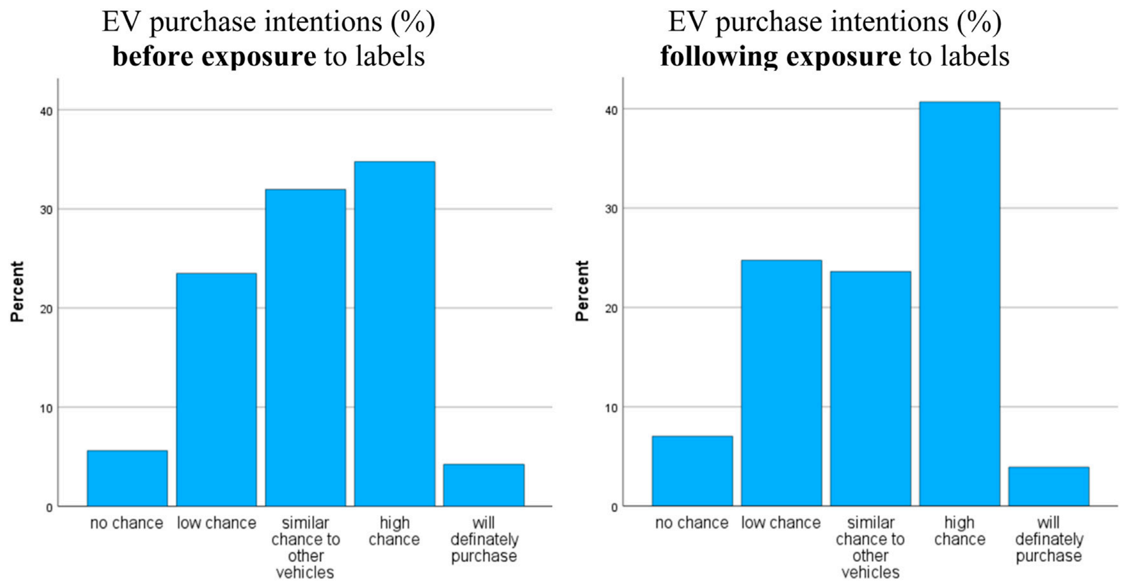


FIGURE 1
Overall EV purchase intentions on a 5-point scale.

range, purchase price, energy efficiency, pollution level, charging time, etc.) are essential factors in EV purchases, as suggested by previous studies (Li et al., 2017; Hille et al., 2018).

To verify the understanding of the labels, we asked respondents: "based on the information you received, which of the following vehicles is with the highest pollution level?" Approximately 91% (1,246 respondents) correctly answered this question, and these respondents are included in the results presented in this article. After exposure to the labels, participants were asked, among other things, to (re-) state their willingness to purchase an EV.

4 Results

The data collected in the experiment were analyzed using multiple regression models to predict individual willingness to purchase an EV after exposure to the labels (the treatment effect). The models include the type of label and the individual's willingness to purchase an EV before the start of the experiment to measure the impact of the label. To obtain a broad understanding of the relationship between exposure to labels and willingness to purchase EVs, the effect of the treatment was examined using two measures of the willingness to purchase an EV, accounting for sociodemographic control variables collected during the experiment. Table 2 presents the correlation matrix for the study's variables. Figure 1 displays the distribution of the variable of purchase intentions before the experiment and following exposure to the labels. An expected finding was a significant correlation between the willingness to purchase an EV as declared in the preliminary part of the experiment and the willingness to purchase an EV after exposure to the energy labels ($r = 0.637$, $p < 0.001$).

Table 3 summarizes the results of the models. Conditions were compared with the control group. Labels with comparative

TABLE 3 Coefficients of linear regression models estimating the effects of energy labels' designs on purchase intentions of EVs (standard errors in parentheses). Conditions with statistically significant effects are in bold.

	EV purchase intentions following exposure to energy labels (scale of 1–5)		Δ In EV purchase intentions (before and after energy label exposure)	
		p-values		*p*-values
Monthly expenditure (condition 1)	**0.172 (0.079)**	**0.029**	**0.216 (0.085)**	**0.011**
Three-year expenditure (condition 2)	**0.259 (0.077)**	**<0.001**	**0.274 (0.083)**	**0.001**
Monthly savings (condition 3)	0.144 (0.077)	0.063	**0.176 (0.084)**	**0.036**
Three-year savings (condition 4)	0.115 (0.079)	0.143	0.126 (0.085)	0.140
Graphical display of expenditure (condition 5)	0.017 (0.079)	0.833	0.005 (0.086)	0.949
Control variables				
EV purchase intentions **before exposure** to energy labels				
No chance				
Low chance	0.407 (0.106)	<0.001		
Chance similar to other vehicles	1.147 (0.104)	<0.001		
High chance	1.815 (0.104)	<0.001		
Definitely will purchase	2.389 (0.148)	<0.001		
Experience with EV	0.501 (0.122)	<0.001	0.297 (0.129)	0.022
Experience with hybrid/plug-in hybrid	−0.061 (0.060)	0.309	−0.135 (0.065)	0.038
Gender (male = 1)	0.052 (0.046)	0.259	−0.014 (0.049)	0.776
Number of vehicles in household	0.055 (0.023)	0.016	0.045 (0.025)	0.072
Children in household (1/0)	0.043 (0.048)	0.366	0.037 (0.052)	0.480
Spouse (1/0)	0.081 (0.055)	0.138	−0.008 (0.059)	0.892
Constant	1.572 (0.124)	<0.001	−0.197 (0.089)	0.027
F	61.274	<0.001	2.571	0.003
R^2	0.427		0.022	
Number of observations	1,246		1,246	

information about monthly energy expenditure (Condition 1) and labels presenting comparative information that combined monthly energy expenditure and expenditure over the first 3 years (Condition 2) had a clear positive effect on the intention to purchase an EV in both models. Additionally, labels with comparative information about monthly energy savings (Condition 3) were found to have a significantly positive impact in one model and a marginally significant positive impact in the other model.

In contrast, labels with comparative information about monthly energy savings and savings over the first 3 years (Condition 4) and a graphical display of expenditure by components (Condition 5) did not significantly affect purchase intent.

To determine if some of the significant treatments were stronger than others, we compared the coefficients of treatments with a significant positive effect using a bias-corrected bootstrap test (1,000 re-samples). There were no statistically significant differences between the coefficients, suggesting that comparing the expenditure labels in conditions 1, 2, neither label exhibited a more pronounced influence on purchase intent. Prior experience with an EV had a positive influence on purchase intent in both models.

However, not all findings were consistent in both models. A higher willingness to purchase was found in households with more vehicles in one model, and was marginally significant in the other model. We also investigated whether consumers' experience with either hybrid or plug-in hybrid vehicles affects their EV purchase intention. In one of the models, respondents who drive these hybrid vehicles demonstrated a significantly lower purchase intention for EVs compared to those without such experience.

5 Discussion

Like in other countries, the adoption of EVs in Israel has seen a substantial increase in recent years. Nonetheless, the readiness of Israeli households to make the transition to these vehicles appears inadequate when considering two key factors: 1) national objectives and 2) the inevitable redirection of marketing efforts by international automobile manufacturers toward countries with less stringent CAFE-like regulations for their polluting vehicle models. To address this shortfall and accelerate the adoption of EVs while discouraging fossil-fueled vehicle purchases, policymakers can leverage nudges as a behavioral economics tool to guide and encourage consumers toward choosing EVs.

In the present study, we conducted an experiment to assess the impact of presenting energy information on labels as "expenditure," "savings," and graphical presentations of expenses on consumers' intentions to purchase EVs. Our findings indicate that presenting energy information on labels as "expenditure" (as opposed to "savings") is more effective in increasing EV purchase intentions. These findings are in line with prior research indicating that framing information as loss (*versus* gain) can potentially incentivize the adoption of energy efficient products, including household appliances (Bull, 2012; Klemick et al., 2015; Stadelmann and Schubert, 2018).

Our experiment used energy information regarding compact or family compact SUV vehicle categories. Dumortier et al. (Dumortier et al., 2015) examined the readiness of consumers to adopt EVs in two groups: 1) Small or medium-sized vehicles, and 2) Small SUVs. They found that information regarding fuel savings for 5 years did not affect either group. Information regarding total expenditure over 5 years affected only those willing to purchase small or medium-sized vehicles. The present study aligns with Dumortier et al., 2015, as we also did not find any effect of information on potential savings. We contribute to the literature by discovering that individuals are influenced by their anticipated expenditure, an aspect not investigated in the prior study.

DellaValle and Zubaryeva (DellaValle and Zubaryeva, 2019) reported that prominently providing information about energy savings is only effective in influencing those who are already motivated to purchase an EV. Moreover, the effect is limited to pro-environmental individuals and those who prefer larger vehicles. While we did not investigate larger vehicles, our contribution lies in demonstrating the effectiveness of framing information as expenditure specifically for compact or family compact SUVs. Importantly, DellaValle and Zubaryeva's study demonstrates that energy information is effective only for specific segments of the population. Previous studies have also documented the differential impact of vehicle-related policies on different segments of the population (Vertlib et al., 2023). This notion aligns with the approach suggested in the present study, which advocates for a choice architecture independent of population segmentation.

6 Limitations

The current research has limitations that could serve as opportunities for future investigations. The automobile market is highly dynamic, with frequent changes anticipated especially in energy efficient vehicle segments (Steren et al., 2022). Due to network externalities in this market, the willingness to adopt electric vehicles is significantly influenced by the growing presence of such cars on the road. In this respect, the present study offers insights into the current stage of EV adoption, one that could change rapidly.

The present study examines a representative sample of the population; however, it focuses on assessing intent to purchase an electric vehicle rather than actual purchasing behavior. Given the disparities between statements of purchase intent and real behavior, future research could explore the effectiveness of energy labels on purchase decisions within automotive dealerships in a field study. Finally, the present study was conducted in Israel, and consumer response to policies is context-dependent and varies across cultures and countries (e.g. Steren et al., 2022; Kochan and Rosenzweig, 2023; Vertlib et al., 2023). Future research could examine differences between countries in consumer responses to energy labels, allowing policymakers to address local nuances in designing such labels.

7 Conclusion

This research underscores the significance of policy measures aimed at addressing cognitive barriers among consumers by leveraging behavioral economics tools. Our findings emphasize that the way comparative information is presented on energy labels can significantly impact consumers' intentions to purchase EVs. The results clearly illustrate that the presentation of information on energy labels has a significant impact on consumer behavior. Specifically, we show that presenting energy information on labels as "expenditure" (as opposed to "savings") is more effective in increasing EV purchase intentions. Policymakers can incorporate these findings into the development and implementation of new labels as part of a comprehensive policy framework aimed at expediting the transition to EVs and achieving national sustainability objectives.

Data availability statement

The raw data supporting the conclusion of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Chairman of the Human Subject Research Committee, Ben-Gurion University of the Negev, Israel. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

GS: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Software, Writing–original draft, Writing–review and editing. SR: Conceptualization, Funding acquisition, Visualization, Methodology, Project administration, Supervision, Writing–original draft, Writing–review and editing. OR: Conceptualization, Funding acquisition, Visualization, Methodology, Project administration, Supervision, Writing–review and editing.

Funding

The author(s) declare financial support was received for the research, authorship, and/or publication of this article. This research was supported by the Israel Ministry of Energy (grant No. 221-11-038).

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

Aasness, M. A., and Odeck, J. (2015). The increase of electric vehicle usage in Norway—incentives and adverse effects. *Eur. Transp. Res. Rev.* 7, 34. doi:10.1007/s12544-015-0182-4

Barth, M., Jugert, P., and Fritsche, I. (2016). Still underdetected – social norms and collective efficacy predict the acceptance of electric vehicles in Germany. *Transp. Res. Part F Traffic Psychol. Behav.* 37, 64–77. doi:10.1016/j.trf.2015.11.011

Bjerkan, K. Y., Nørbech, T. E., and Nordtømme, M. E. (2016). Incentives for promoting battery electric vehicle (BEV) adoption in Norway. *Transp. Res. Part D Transp. Environ.* 43, 169–180. doi:10.1016/j.trd.2015.12.002

Bull, J. (2012). Loads of green washing—can behavioural economics increase willingness-to-pay for efficient washing machines in the UK? *Energy Policy* 50, 242–252. doi:10.1016/j.enpol.2012.07.001

CBS (2022). Israel central Bureau of Statistics motorized vehicles in Israel. Available online: http://tinyurl.com/5dhbjatm (accessed on November 18, 2023).

Degirmenci, K., and Breitner, M. H. (2017). Consumer purchase intentions for electric vehicles: is green more important than price and range? *Transp. Res. Part D Transp. Environ.* 51, 250–260. doi:10.1016/j.trd.2017.01.001

DellaValle, N., and Zubaryeva, A. (2019). Can we hope for a collective shift in electric vehicle adoption? Testing salience and norm-based interventions in south tyrol, Italy. *Energy Res. Soc. Sci.* 55, 46–61. doi:10.1016/j.erss.2019.05.005

Dimitropoulos, A., Oueslati, W., and Sintek, C. (2018). The rebound effect in road transport: a meta-analysis of empirical studies. *Energy Econ.* 75, 163–179. doi:10.1016/j.eneco.2018.07.021

Dumortier, J., Siddiki, S., Carley, S., Cisney, J., Krause, R. M., Lane, B. W., et al. (2015). Effects of providing total cost of ownership information on consumers' intent to purchase a hybrid or plug-in electric vehicle. *Transp. Res. Part A Policy Pract.* 72, 71–86. doi:10.1016/j.tra.2014.12.005

Gigerenzer, G., and Gaissmaier, W. (2011). Heuristic decision making. *Annu. Rev. Psychol.* 62, 451–482. doi:10.1146/annurev-psych-120709-145346

Goren, C. (2023). Best-selling car models in Israel for 2022. Available online: https://tinyurl.com/yc8nbstf (accessed on November 18, 2023).

Green, E. H., Skerlos, S. J., and Winebrake, J. J. (2014). Increasing electric vehicle policy efficiency and effectiveness by reducing mainstream market bias. *Energy Policy* 65, 562–566. doi:10.1016/j.enpol.2013.10.024

Hille, S. L., Geiger, C., Loock, M., and Peloza, J. (2018). Best in class or simply the best? The impact of absolute versus relative ecolabeling approaches. *J. Public Policy and Mark.* 37, 5–22. doi:10.1509/jppm.15.030

Huang, Y., and Qian, L. (2018). Consumer preferences for electric vehicles in lower tier cities of China: evidences from south jiangsu region. *Transp. Res. Part D Transp. Environ.* 63, 482–497. doi:10.1016/j.trd.2018.06.017

IEA (2023a). International energy agency global EV outlook 2023 – Analysis. Available online: https://www.iea.org/reports/global-ev-outlook-2023 (accessed on November 16, 2023).

IEA (2023b). International energy agency global fuel Economy initiative 2021 – Analysis. Available online: https://www.iea.org/reports/global-fuel-economy-initiative-2021 (accessed on November 18, 2023).

Klemick, H., Kopits, E., Wolverton, A., and Sargent, K. (2015). Heavy-duty trucking and the energy efficiency paradox: evidence from focus groups and interviews. *Transp. Res. Part A Policy Pract.* 77, 154–166. doi:10.1016/j.tra.2015.04.004

Kochan, Y., and Rosenzweig, S. (2023). Unintended consequences of antismoking pricing policies: insights from smokers' household expenditure on smoking behavior and public health. *Sustainability* 16, 178. doi:10.3390/su16010178

Krause, R. M., Lane, B. W., Carley, S., and Graham, J. D. (2016). Assessing demand by urban consumers for plug-in electric vehicles under future cost and technological scenarios. *Int. J. Sustain. Transp.* 10, 742–751. doi:10.1080/15568318.2016.1148213

Langbroek, J. H. M., Franklin, J. P., and Susilo, Y. O. (2016). The effect of policy incentives on electric vehicle adoption. *Energy Policy* 94, 94–103. doi:10.1016/j.enpol.2016.03.050

Li, L., Wang, Z., Chen, L., and Wang, Z. (2020). Consumer preferences for battery electric vehicles: a choice experimental survey in China. *Transp. Res. Part D Transp. Environ.* 78, 102185. doi:10.1016/j.trd.2019.11.014

Li, W., Long, R., Chen, H., and Geng, J. (2017). A review of factors influencing consumer intentions to adopt battery electric vehicles. *Renew. Sustain. Energy Rev.* 78, 318–328. doi:10.1016/j.rser.2017.04.076

Lichtenstein, S., and Slovic, P. (2006). *The construction of preference: an overview*. (Cambridge, England: Cambridge University Press). ISBN 978-0-521-54220-3

McNeill, D. L., and Wilkie, W. L. (1979). Public policy and consumer information: impact of the new energy labels. *J. Consumer Res.* 6, 1–11. doi:10.1086/208743

Mertens, S., Herberz, M., Hahnel, U. J. J., and Brosch, T. (2022). The effectiveness of nudging: a meta-analysis of choice architecture interventions across behavioral domains. *Proc. Natl. Acad. Sci. U.S.A.* 119, e2107346118. doi:10.1073/pnas.2107346118

Mohamed, M., Higgins, C., Ferguson, M., and Kanaroglou, P. (2016). Identifying and characterizing potential electric vehicle adopters in Canada: a two-stage modelling approach. *Transp. Policy* 52, 100–112. doi:10.1016/j.tranpol.2016.07.006

Orlov, A., and Kallbekken, S. (2019). The impact of consumer attitudes towards energy efficiency on car choice: survey results from Norway. *J. Clean. Prod.* 214, 816–822. doi:10.1016/j.jclepro.2018.12.326

Payne, J. W., Bettman, J. R., and Johnson, E. J. (1992). Behavioral decision research: a constructive processing perspective. *Annu. Rev. Psychol.* 43, 87–131. doi:10.1146/annurev.ps.43.020192.000511

She, Z.-Y., Sun, Q., Ma, J.-J., and Xie, B.-C. (2017). What are the barriers to widespread adoption of battery electric vehicles? A survey of public perception in tianjin, China. *Transp. Policy* 56, 29–40. doi:10.1016/j.tranpol.2017.03.001

Stadelmann, M., and Schubert, R. (2018). How do different designs of energy labels influence purchases of household appliances? A field study in Switzerland. *Ecol. Econ.* 144, 112–123. doi:10.1016/j.ecolecon.2017.07.031

Steren, A., Rubin, O. D., and Rosenzweig, S. (2022). Energy-efficiency policies targeting consumers may not save energy in the long run: a rebound effect that cannot Be ignored. *Energy Res. Soc. Sci.* 90, 102600. doi:10.1016/j.erss.2022.102600

Tarei, P. K., Chand, P., and Gupta, H. (2021). Barriers to the adoption of electric vehicles: evidence from India. *J. Clean. Prod.* 291, 125847. doi:10.1016/j.jclepro.2021.125847

Thaler, R. H., and Sunstein, C. R. N. (2009). *Improving decisions about health, wealth, and happiness*. Westminster, London: Penguin. ISBN 0-14-311526-X.

Vertlib, S. R., Rosenzweig, S., Rubin, O. D., and Steren, A. (2023). Are car safety systems associated with more speeding violations? Evidence from police records in Israel. *PLoS ONE* 18, e0286622. doi:10.1371/journal.pone.0286622

Waechter, S., Sütterlin, B., and Siegrist, M. (2015). Desired and undesired effects of energy labels—an eye-tracking study. *PLOS ONE* 10, e0134132. doi:10.1371/journal.pone.0134132

Ye, F., Kang, W., Li, L., and Wang, Z. (2021). Why do consumers choose to buy electric vehicles? A paired data Analysis of purchase intention configurations. *Transp. Res. Part A Policy Pract.* 147, 14–27. doi:10.1016/j.tra.2021.02.014

Zou, L. W., and Chan, R. Y. K. (2019). Why and when do consumers perform green behaviors? An examination of regulatory focus and ethical ideology. *J. Bus. Res.* 94, 113–127. doi:10.1016/j.jbusres.2018.04.006