World Electric Vehicle Journal

MDPI

Article

Reasons Why Only Kuwaiti Citizens Drive Electric Vehicles despite Being Only a Quarter of the Population

Sumayya Banna [1], Andri Ottesen [2,*] and Basil Alzougool [1]

[1] LSE Middle East Centre (MEC), Arab Open University (AOU), Ardiya P.O. Box 830, Kuwait; sumayya@aou.edu.kw (S.B.); balzougool@aou.edu.kw (B.A.)
[2] LSE Middle East Centre (MEC)—Sustainability Research and Consultancy (CSRC), Australian University (AU), West Mishref P.O. Box 1411, Kuwait
* Correspondence: a.ottesen@au.edu.kw

Abstract: The adoption of fully battery-powered electric vehicles (EVs) in Kuwait is currently at less than one percent of the population, and hence Kuwait has the lowest index rank among countries around the globe. Effectively, only Kuwaiti nationals have the opportunity to own EVs, as there are no fast direct-current charging stations in Kuwait, and Kuwaiti landlords (expats cannot own real estate) do not allow the installation of EV-charging home wall boxes at their rented properties. Given these facts, this paper only focuses on the preferences of Kuwaiti nationals, even though they only constitute 25 percent of the population of Kuwait. To accomplish the present objectives, a quantitative descriptive method (closed-ended questions) was used to collect data from a sample of 227 Kuwaiti nationals who were representative of the owners of half a million internal combustion engine (ICE) cars and that were categorized as early majority consumers. The findings of the present study indicate that over 50 percent of the respondents would prefer to buy an EV in the following three years when certain criteria were satisfied, including government-controlled pricing policies and recharging point availability, high-speed roads, and free EV-dedicated parking spaces. Furthermore, over 40 percent of respondents stated that they would contemplate purchasing an electric vehicle if the price of gasoline or diesel increased by 19 to 50 percent. The findings also indicated that more than 40 percent of respondents believed that EVs are fire- and crash-safe, and roughly 50 percent of the respondents would be willing to pay between 6 and 20% more for an EV because they believe that EVs are ecofriendlier vehicles and are significantly faster than conventional petrol vehicles. Additionally, respondents rewarded those vehicles with an excellent mark because of their ecological, economical, and technological attributes and benefits.

Keywords: electric vehicles; green transport; carbon footprint; Kuwaiti national customer preference

Citation: Banna, S.; Ottesen, A.; Alzougool, B. Reasons Why Only Kuwaiti Citizens Drive Electric Vehicles despite Being Only a Quarter of the Population. *World Electr. Veh. J.* **2023**, *14*, 287. https://doi.org/10.3390/wevj14100287

Academic Editors: Wenbin Yu and Guang Zeng

Received: 27 August 2023
Revised: 21 September 2023
Accepted: 28 September 2023
Published: 10 October 2023

1. Introduction and Significance

The Pathway for the Reduction of Greenhouse Gas (GHG) Emissions in Kuwait

In 2021, Kuwait emitted 25 tons of CO_2 per capita, which was the third highest in the world after its neighbors Qatar and Bahrain (36 and 27 tons of CO_2 per capita, respectively). This made Kuwait's carbon emissions more than four times higher than the average in 28 European Union countries (6.1 tons of CO_2 per capita) [1–3]. The State of Kuwait has pledged to the United Nations to reduce GHG emissions by adopting a "low carbon equivalent emission economy". In its first NDC, submitted in April 2018, Kuwait outlined its action plan to reduce greenhouse gas emissions via launching its Shayaya Renewable Energy Park, a 3.2 GWe renewable solar and wind energy compound, and the creation of a mass transit (metro) system that has yet to be realized 5 years later. There are some issues of consistency and clarity in the Kuwaiti government's pledge to reduce greenhouse gas emissions and its action plan, as "there is no discussion of what this pledge entails or how it should be implemented" [4,5]. The largest emitting sector is electricity generation

(58 percent), which is primarily used for air cooling through the use of air conditioning and for the desalination of saline water in the world's hottest and driest climate conditions. The oil and gas sector is responsible for 11% of GHG emissions, whereas the transport segment of the economy is accountable for 18% of GHG emissions [6,7]. This paper aims to provide a viable path for GHG reduction by greening the transportation sector, and specifically, by transitioning from internal combustion engine (ICE) automobiles to electric vehicles (EVs) [8].

Currently, the total ownership of EVs is only about 400 vehicles (about 300 registered in Kuwait and about 100 that are estimated to drive there using a foreign license plate) [9]. This is extremely low, especially compared to Norway, the nation with the highest rate of EV adoption and with a similar population to Kuwait; Norway has over 650,000 of fully electric passenger cars and another about 200,000 Plug-In-Hybrids on the road, that is, more than one out of every four passenger cars [10]. Hence, Kuwaiti EV adoptions are 1500 times lower than the best-in-class. At the heart of this low adoption is the lack of DC fast-charging stations; Norway has about 22,000 public charging stations compared to 42 slow alternating current (AC) and no-fast-charging direct current (DC) stations in Kuwait [11,12]. What even further limits electromobility adoption, according to our interviews with all the EV car dealers and 12 current owners of EVs in Kuwait, is that Kuwaiti landlords will not allow installations of home wall boxes for their tenants, who are mostly expats who are prohibited by law to own real estate. A total lack of fast-charging DC stations and an effective ban on the installation of home-charging equipment effectively results in only Kuwaiti nationals who own their own house being able to own and operate EVs in Kuwait.

2. Background

2.1. Lowering GHG Emissions in the Transportation Sector

Only 0.2% of transportation in Kuwait is via public transport, primarily due to a lack of bus infrastructure, cultural conventions, and extreme climate conditions. There have been no campaigns or other government initiatives to promote or encourage the general public's use of public transportation [9]. Private automobiles are predominantly utilized by the majority of Kuwaiti citizens, and hence appear to be the most prevalent mode of transportation. Only about 600,000 of the 2.3 million vehicles registered in Kuwait belong to expats, who account for 70% of residents versus 30% being citizens [10]. In addition, approximately 90 percent of the 295 EVs registered in Kuwait between 2019 and March 2023 were owned by Kuwaitis [11]. One of the reasons why expats in Kuwait do not purchase electric vehicles is the absence of fast-charging stations and the refusal of landlords to enable tenants to install EV-charging wall boxes in rented properties. Kuwaiti citizens tend to live in their own houses as a result of various government programs, whereas expats are prohibited from owning real estate in Kuwait; as a result, most expatriates are forced to rent apartments and must obtain approval from their landlords for the installation of charging equipment, which is typically denied [12,13].

2.2. The Reason Electric Vehicles Are Optimal for Zero-Emission Transportation

In terms of vehicle efficiency, electric vehicles are the best adapted to reduce the carbon footprint and they have the lowest operating expenses. Mr. Abu Dagga, the director of Powerid Germany, believes that e-mobility is the key to sustainability and the high ground against climate change. The primary reason is that e-mobility is superior to ICE transportation, regardless of whether the fuel source is petroleum, diesel, or natural gas, particularly when energy losses are considered. Front-end well-to-tank investigations reveal that EVs lose approximately 6% of their energy compared to 45% in petroleum-powered vehicles [14,15]. Additionally, rear-end tank-wheels studies reveal an additional 17% energy loss for EVs compared to a 35% energy loss for diesel-powered vehicles, and a 39% energy loss for gasoline-powered vehicles, where the majority of that energy is lost as excess heat that is not converted into energy for the wheels. EVs are up to five times more effective than gasoline-powered internal combustion engine (ICE) vehicles, proving

their superiority in reducing greenhouse gas emissions (See Figure 1). The efficiency of EVs over ICEs is today three times more, but will be four times more efficient in 20 years, as EV batteries will become lighter and more efficient in terms of energy storage and transfer with new technologies, such as the solid-state batteries and EV batteries having a second life as energy storage for wind and solar farms [16]. Although EV batteries are generally disposed of with the car or replaced after their charging capacity goes below the warranty terms, which are usually from 70 to 75%, they present a cheap option in making up battery packs in a container system, as they are repurposed to store solar energy overnight when the sun is not shining. A good example of that is the 25 MWh grid-scale energy-storage system in California, where approximately 1300 disposed Honda and Nissan EV batteries are strung together in the B2U SEPV Sierra hybrid solar-storage facility, which uses slower charging time than the high-performance EVs [17,18]. The cost of installing such a system is USD 200 per kilowatt hour, as the batteries do not need refurbishing [19]. Lithium recycling factories are also coming fast online, such as the Li Cycle Rochester facility where the company claims to be able to recapture up to 95% of the battery resources for recycling using a closed-system water-based solution where the minerals are captured in a "black mass" that is then reseparated into battery-grade lithium, cobalt, and nickel, as well as other materials to be reused [20]. However, according to Powerid [16], hydrogen is not as suitable for smaller vehicles as it is for heavy-duty transport or construction vehicles, large sea vessels, or even aircrafts, due to its lack of energy efficiency, storage, and transportation complications, and a flame speed that is 10 times that of methane gas and thus more explosive [21,22]. This view is in stark contrast to that of Toyota and other Japanese automakers, who favor hydrogen as the primary source of zero-emission technology due to its rapid charging and long range, as they appear to be losing the EV world market [23].

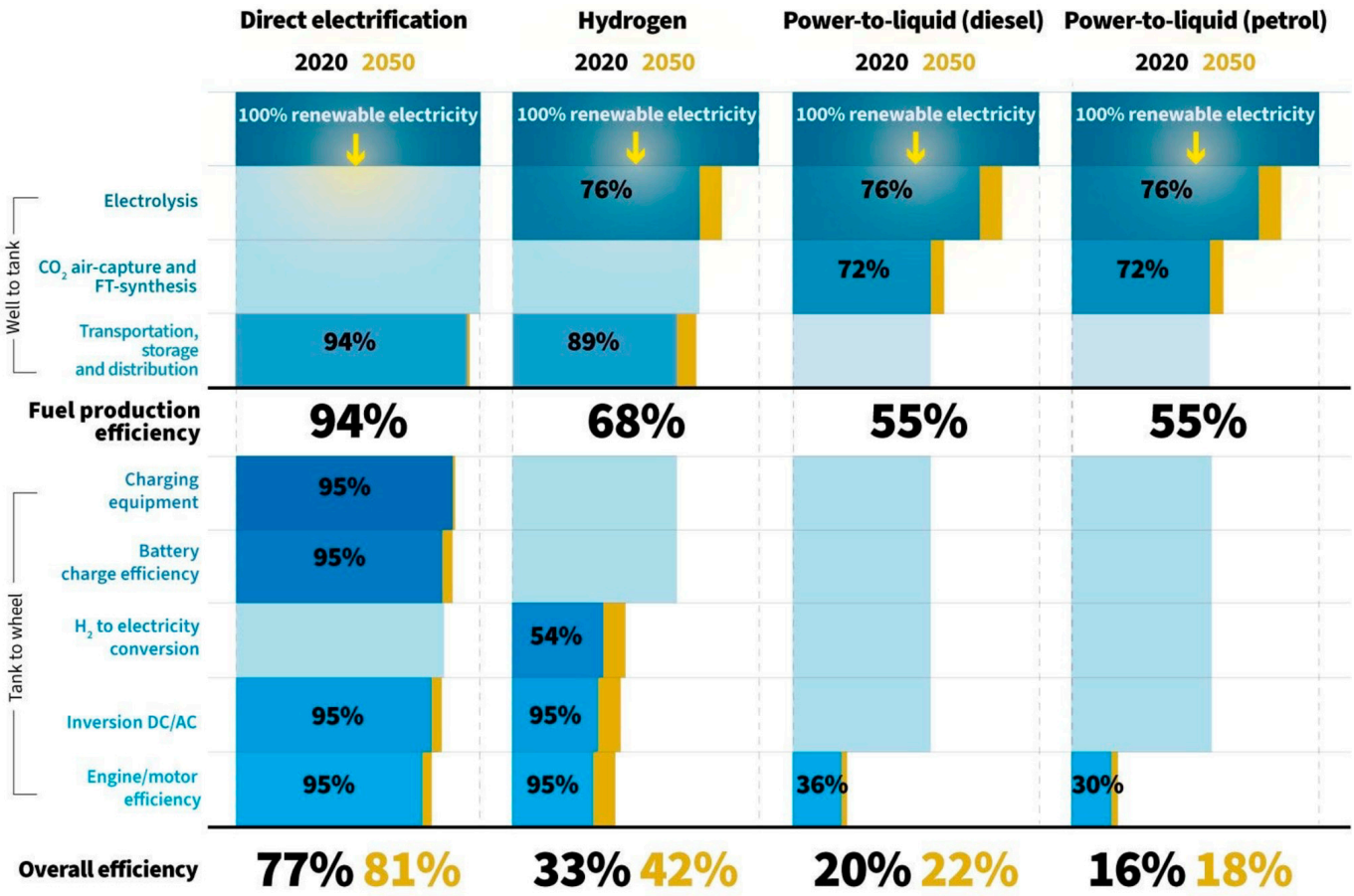

Figure 1. Vehicle fuel energy efficiency; source: Powerid. Printed with permission [16].

2.3. The Oil Savings for Each Electric Vehicle

With each transition from internal combustion engines (ICEs) to EVs, oil that would have been used for combustion is saved. This equates to approximately 10 barrels of oil equivalent (BOI) per year for a midsize car, one barrel for a motorcycle, 244 barrels for an A-class vehicle, and 274 barrels for a bus [24]. By the end of 2022, over 20 million electric vehicles will have been sold [25]. The transition from ICEs to EVs is anticipated to conserve 2.5 m petrol barrels per day by 2025, which is roughly equivalent to the everyday petrol production of Kuwait, the tenth-largest oil producer [26,27]. BloombergNEF predicts that the demand for oil will plateau in 2026, and will start to decline in 2027 as a result of the conversion from ICEs to EVs for all vehicle types. The Tesla Model-Y just took over the Toyota Corolla as the world's sales-record-breaking automobile for the first quarter for year 2023, with 267,200 vehicles sold compared to 256,400 for the Toyota Corolla [28].

2.4. Low Maintenance of Electric Vehicles

EVs have lower maintenance costs than internal combustion engine (ICE) vehicles due to the factors listed below. EVs have significantly fewer mechanical components or moving parts than ICE vehicles, with approximately 20 moving parts for EVs compared to approximately 2000 parts for ICE vehicles [29]. Fewer components translate to fewer items that can fail or wear out over time, resulting in lower maintenance costs. The US Energy Department (Office of Energy Efficiency and Renewable Energy) determined in 2021 that maintenance costs for EVs were only 6.1 cents per mile (4 cents per kilometer) compared to ICE costs of 10.1 cents per mile [30]. The following are the EERE study's explanations for this disparity: (A) Unlike ICE vehicles, EVs do not require regular lubricant replacements; (B) Electric vehicles utilize regenerative braking, which pauses the vehicle by converting the electric motor into a generator to recharge the battery. This reduces the frequency of replacing brake pads and rotors by minimizing system wear and tear. EVs lack exhaust systems, which are susceptible to corrosion and other damage in ICE vehicles. ICE vehicles require regular battery maintenance or replacement, whereas EV batteries are designed to last a very long time, often the life of the vehicle; (C) ICE vehicles require more frequent flushing of the refrigerant and other maintenance on the refrigeration system. EVs typically have less stringent cooling requirements, which further reduces their maintenance needs; (D) EVs have no gasoline pumps, fuel injectors, or fuel containers to maintain and replace; (E) Due to their simplicity and lack of moving parts, electric motors are exceptionally durable and can outlast the rest of the vehicle with minimal or no maintenance; (F) EVs have a gearless powertrain and, as a result, no (automatic) transmission (AT), which in ICE vehicles often requires costly maintenance. Altogether, these factors can save a substantial amount of money over the tenure of an EV versus an ICE vehicle.

2.5. The Durability of the EV Battery Dependence

Evidently, while routine maintenance on EVs is typically much less expensive, replacing the EV battery after the warranty expires after 8–10 years can be quite costly (Kia/Hyundai and Mercedes offer 10 years and lifetime warranties for the Hyundai Ioniq). The battery replacement cost (USD 5000–15,000) may determine the vehicle's lifespan, which is approximately 13 years for ICE vehicles [14]. EV resale value depreciation versus ICE resale value depreciation may represent the greatest operational cost if the battery does not last. Fortunately, the majority of studies indicate that EV batteries will outlive the vehicle, with over 70% of their charging capacity remaining after 13 years of use. One can anticipate a loss of 2.3% of range per charge for every year driven, which equates to approximately 13 years or 240,000 km driven before the charging capacity falls below 70% of its initial capacity [31]. According to industry sources, if the original battery is large enough, a 50% charge may suffice for the majority of usage, extending the EV's lifespan to 20 years. The Nissan Leaf has been on the market for thirteen years, and a significant number of original vehicles are still on the road. Tesla also reports empirical data of average EV utilization of 300,000 km in the United States and 244,000 km in Europe [32]. Tony Seba,

a Stanford technology forecaster, states in a recent report by RethinkX from March 2023 that the longevity and autonomy of EVs will be such that sales of new automobiles will plummet by 75% over the next 20 years, giving some hope that EV depreciation will not outweigh ICEs and that operational costs (OPEX) will be lower [33]. He also predicts that the EVs will take over the ICEs much faster than predicted based on his S-curve cost-lowering predictions for emerging technology, and that Chinese-made EVs will take over as the mainstream consumer choice in the very near future because of value for money and technology and quality improvements while lowering the cost per MW of charging capacity in production of the EV battery.

On the other hand, it is a known fact that EV batteries degrade more quickly, and the majority of studies on the durability of EV batteries were conducted in Europe or North America. The Kuwait Institute of Scientific Research (KISR), the national laboratory of Kuwait, has conducted its own research with promising results [34,35]. However, due to the lack of years that EVs have existed in Kuwait, real-world empirical data are still deficient and do not provide conclusive evidence regarding how long EV batteries will last in extreme heat conditions. The Kingdom of Saudi Arabia (KSA) recently bought a controlling stake in US Lucid Motors with the intention of producing a quarter of the production in KSA or a total of half a million vehicles by 2030 and the first car by 2025. Similarly, the Investment Promotion Agency Qatar is exploring if the country can be an EV manufacturing hub for the Middle Eastern (Arab) region in cooperation with German Volkswagen and Chinese Gaussin and Yutong, with whom the Qatari government has already partnered [36]. It is clear that the issue of EV driving with atmospheric heat reaching above 50 °C has to be dealt with both in terms of battery cooling and durability of the battery. In normal driving conditions for EVs, which are between 10 °C and 40 °C, the battery is at its nominal use capacity; at higher temperatures, the use capacity decreases, and between 60 °C and 70 °C the battery could sustain permanent damage [37].

2.6. EV Policies of the Kuwait Government as Opposed to Qatar

The Government of Kuwait will have to set goals of its transitions from conventional ICE vehicles to EVs, which in turn can offer a tremendous opportunity to reduce GHG emissions. The government of the State of Kuwait has pledged to the UN to reduce its carbon footprint as a vital share of its own national vision of 2035, which in particular contains a sustainability objective that promotes urgent actions to be implemented to fight off climate change effects [38,39]. However, conversion to EVs is not mentioned in these documents.

Qatar's national vision, much like the Kuwaiti Vision 2035, serves as a guide for the country's social, economic, environmental, and human development. However, in Qatar's vision, commitment has already been made to achieving a 25% reduction in greenhouse gas emissions by 2030. The Qataris plan to achieve this goal by converting all public transportation to electric vehicles, as well as giving significant governmental supports to various initiatives to transition to green mobility. Qatar's 'Electric Vehicle Strategy 2021' anticipates that EV sales will account for 10% of total vehicle sales in Qatar by 2030, contributing to the CO_2 reduction goals of the Paris Agreement [40].

2.7. Fast-Charging Stations in Kuwait and Qatar

Apart from the need for clear governmental goals on EV transformation, the automotive dealers in Kuwait state that the biggest hurdle for rapid mass adoption of EVs is the lack of fast-charging stations. Currently, there are no fast direct current (DC) to DC charging stations installed in Kuwait, and only 38 slow alternating current (AC) to DC charging stations spread around urban areas of Kuwait. The EV-charging facility provider ChargedKw recommends as a start to install one fast-charging station at every of the 150 gas stations in Kuwait, but due to a backlog of orders with the suppliers, the bidding process completion of this installment is likely to take 2.5 years from the initial tender, and the likely cost will be around KD 2.3 million, which is equivalent to nearly USD 8 million [41,42].

Qatar, which has half the land mass and population of Kuwait and lies 800 km south of Kuwait, is considerably father ahead in the installation of fast charging stations. As of the end of 2022, there were 100 such stations installed, and 150 installations are scheduled for 2023. Mohamed Khalid al-Sharshani, the head of the technical section at Tarsheed, which is the National Program for Conservation and Energy Efficiency, states that 600–1000 such stations will be installed by 2025 [43,44]. The rise of the fast-charging station has spurred the electrification of public transport: "We have crossed the target of converting 25 percent of the public transportation into eco-friendly mode. The public and school transportation will be completely eco-friendly by 2030", states the Minister of Transport Jassim Saif Ahmed Al Sulaiti [45,46]. Apart from aiming for 100% electric public transport by 2030, Qatar authorities still have a modest goal of transforming only 10% of all new sales in all sectors of transportation to electric, as many will be reluctant to change from their ICE vehicle given the low price of gasoline of QR 2 per liter, or about USD C 50 [47].

3. Literature Review

In general, the existing literature suggests that successful transformations and transitions are required to increase the adoption of sustainable e-mobility and surmount barriers to its adoption. While practitioners, academics, and researchers have studied the EV phenomenon on an international scale and with country-specific evidence, limited evidence has been found, however, from an emerging market of Kuwait. Apparently, there is insufficient research that has been conducted among drivers of ICE vehicles that aims to know their future stated preferences for EVs. This study had three goals: (i) to examine Kuwaiti ICE vehicle drivers' indicated perceptions of EV attitudes; (ii) to identify their preferable EV features; (iii) to determine their prospective EV purchase requirements and conditions. This research is part of a larger initiative that examines the EV landscape in Kuwait and utilizes a mixed-methods approach [48].

In summary, the recent EV literature reviews emphasized the following stated attributes for EVs:

(1) Economic: upfront purchasing prices, maintenance and repairs cost, protection and insurance cost, charging costs [49,50], and guarantees costs [51,52];
(2) Technology characteristics: battery, range, top speed, and acceleration [53–55];
(3) Infrastructure characteristics, including sluggish and rapid-charge networks, commercial and charging public infrastructures, and home-recharging infrastructures [56];
(4) Financial, nonfinancial, and social attributes: free parking spots, price reduction, government subsidy policies, health policies and safety policies [57], tax-discount policies, and penalty policies for petrol-fueled vehicles [58];
(5) Brand attributes: design, brand reputation, and credibility [59].

Interestingly, few studies were found that aimed to investigate these aforementioned attributes. In the following respects, the present study complements the current literature as follows: first, the current study applies five categories of attributes, including economic, technical, infrastructure, brand, and financial and nonfinancial policy attributes, collectively and exhaustively on a single set of options for EV preferences. Importantly, the attributes have not been investigated collectively in a single study; rather, they have been analyzed in various existing studies. Second, indeed, the present investigation focuses on conventional automobile drivers that have never been investigated. Lastly, the current research closes a void in the literature on EV trends in terms of demographics and stated preferences through a large sample survey collected in Kuwait. As the six gulf countries share similar societies, cultures, economies, government policies, climates, and geography, the present study contributes to the growing body of knowledge that can be applied to consumers in other GCC countries—Oman, the Saudi Arabian Peninsula, along with Bahrain, Qatar, and the UAE—regarding markets and stated preferences for EVs. Most studies focused on markets in developed nations such as Europe, the United States, and Australia. For instance, Guerra and Daziano analyzed a large sample of respondents' EV purchase motivations in the United States. Consumers were generally willing to pay more for longer-ranging

vehicles with shortened recharging periods, reduced operating costs due to scheduled and unscheduled maintenance, and shorter parking and charge facility search times, according to their findings [60].

By contrast, ICE vehicles continue to be perceived as more comfortable in terms of design and appearance than EVs, particularly among senior consumers. Moreover, women were discovered to be more environmentally conscious than males. Ziemba discovered that, in Poland, consumer EV acceptability is most strongly influenced by technological standards [61]. For instance, Vilchez conducted a large-scale survey among vehicle owners in a number of European nations, including Italy, France, Germany, Spain, Poland, and the UK, and found that half of the participants did not prefer EVs due to the higher initial capital cost (CAPEX)—a higher cost than conventional automobiles [62]. Fortunately, a recent study conducted by Temple found that the production of new batteries (lithium-metal batteries) could make EVs as affordable and convenient as gasoline-powered vehicles, indicating an anticipated increase in the adoption rates among car drivers worldwide as a result of technological development [63].

Kowalska-Pyzalska examined consumer preferences for alternative-fuel vehicles or electric vehicles (EVs) in Central and Eastern European nations and found that safety attributes are one of the most sought-after characteristics of EVs, followed by price, range, and brand [64]. Their findings require automakers and policymakers to actively promote electric vehicles in order to increase their adoption rates. Chao Ma analyzed the preferences of Chinese consumers for electric vehicles and found that purchase price, vehicle category, and fast-charging batteries were the most influential factors. Government policy is crucial in promoting the adoption of electric vehicles [65].

4. Methods

This study employed a quantitative descriptive approach consisting of mainly closed-ended questions to accomplish its research objectives by designing a large-scale questionnaire survey to provide a comprehensive, all-inclusive perspective on EVs in Kuwait. The first section of the extensive survey centered on respondents' demographic information, such as their gender, age, level of education, income ranges, occupation, ethnicity, and vehicle ownership. In order to measure the respondents' approach to willingness-to-buy or pay, the second section of the extensive survey consisted of exhaustive questionnaires about EV features, factors, and attributes that have been intensively discussed by the majority of the existing and updated strands of the literature. In addition, the large-scale survey was distributed to and evaluated by 50 full-time instructors and part-time educators, who provided their views and recommendations. The assessment phase comprised inquiries regarding objective, content, and layout of the questionnaire. We received 30 completed evaluations in total as part of the validation process. The overall response rate was near 60%. We subsequently incorporated the suggested modifications and revised the questionnaire's format and overall design proposed mainly by AOU instructors. To make the questionnaire easier to complete, we omitted several sections and treated it as a unit. In addition, we added the response option "I don't know" in order to collect honest responses and permit the free expression of opinions. The evaluation revealed that approximately 96% of the questionnaire's content is unambiguous, informative, and simple to understand. Similarly, 93 percent of questionnaire objectives are clearly specified, the content is relevant, and the order is logical. Of the respondents, 90 percent indicated that the content is correct and complete, and the layout is workable, and 86 percent agreed that the structure is straightforward. We developed two variants of the questionnaire; one version was written in the Arabic language and another in the English language. We used Google Forms to formulate the survey because it is one of the commonly used, validated tools for data collection. The questionnaire was then disseminated to diverse groups in Kuwait, including the general public, faculty members, students, and tutors. Participants had to be Kuwaiti citizens and 18 years of age and also hold a driver's license and a car in their own or family name in order to be eligible for the survey. We proposed this condition as many Kuwaitis use private

drivers to get around and do not possess a driving license. We believe that purchasing behavior for a car that is driven by a driver is different than purchasing behavior for a car that is driven by the owner. We started the data-collection phase from February to May of 2022. A technique of random sampling was utilized during the data-collection phase [66]. The researchers distributed the survey links by randomly selecting the target audience from diverse groups of individual nationals in Kuwait inclusive of mature students, instructors, professionals, and others. Moreover, the study sample included a few Kuwait individuals with temporary or permanent car-ownership contracts such as rental or a company car. Those were contractual employees who were provided with ICE automobiles from their employing companies with petrol paid.

Initially, we collected a large sample size (604) in order to obtain comprehensive demographic data representative of the population in Kuwait and to draw actionable conclusions about the population. Subsequently, we eliminated around 132 surveys because our aim was not to include those who never drive a car or had no driving license, and we ended up with a total of 472 questionnaires that were analyzed, and these data were used for our current analysis. However, after observing how Kuwaiti nationals had different EV purchasing behavior from the expat population, due to strict rules and restrictions expats have to adhere to in order to obtain a driver's license within the State of Kuwait, as well as expats not being allowed to own real estate and landlords not permitting installation of home charging for EVs, and as a result almost all EV buyers to date have been Kuwaiti nationals, after careful selection, we isolated the Kuwait nationals in our sample and obtained a reduced sample of 227 Kuwaiti nationals who owned and drove conventional vehicles.

At the beginning of the data-collection phase, the purpose and aims of the study were introduced to the participants and thoroughly explained. Additionally, instructions were written on the front page to prevent confusion. Then, we invited participants to complete the survey online. Finally, descriptive statistics—frequencies and percentages—were computed using SPSS 19, applying *t*-test and AVOVA tables for in-depth analysis and standard error analysis. Note that this particular endeavor has certain limitations. Because the sample was gathered from a single location, the Arab Open University in Kuwait, we are precluded from generalizing to the context of all Kuwaiti drivers. In fact, additional research with a larger sample size is required on this specific topic. For example, in-depth investigations are necessary to uncover concealed insights regarding the acceptance and preferences associated with EV use among EV owners. One of the requirements for participation in the survey was automobile ownership. In 2021, approximately 3 million vehicles were registered in the country [14]. Excluding company-owned and expat-registered vehicles, we estimate that approximately 1.6 million registered vehicles were owned by Kuwaiti citizens. Here, we examined prospective buyers and, hence, we estimated that forty percent of the population, or 6,400,000, were included in the group of prospective Kuwaiti drivers. The sample consisted of 227 Kuwaiti drivers and vehicle proprietors, or approximately 0.04 percent of the total representative population, which is modest and, if not for our resource limitations, would have ideally included at least 1000 participants. Consequently, our margin of error is approximately ± 7 percent, which translates to a 95% confidence level [67].

5. Findings

This investigation included the participation of two-hundred twenty-seven Kuwaiti ICE owners who possessed driving licenses. Table 1 provides a demographic characteristics summary. The questionnaire was completed equally by men (50.2%) and women (49.8%). More than three-quarters of the sample were between 26 years old and 39 years old (76.2%). Over one-third were unmarried (37.4%), while 25.6% were married with at least three children. Over fifty percent held bachelor's degrees. More than a fourth of respondents owned five or more automobiles (40.1%), and more than a quarter of them owned two automobiles (28.2%). More than half of the participants (53.3%), versus slightly above a

quarter (26%), were working in the public and private sectors, respectively. Over one-third of the sample (39.6%) worked in the public and government ministries sector, and a quarter (25.6%) were intermediate managers. A total of 32.6% of the participants had a monthly income of between KD 1000 and 1499.

Table 1. Demographic characteristics summary.

Variable	Categories	N = 227	%
Gender	Male	114	50.2%
	Female	113	49.8%
Age Range	26–39 years	173	76.2%
	40–49 years	42	18.5%
	50–60 years	12	5.3%
Marital Status	Single	85	37.4%
	Married without kids	24	10.6%
	Married with 1 kid	26	11.5%
	Married with 2 kids	34	15.0%
	Married with 3 kids or more	58	25.6%
Number of Cars in household	One car	12	5.3%
	Two cars	64	28.2%
	Three cars	27	11.9%
	Four cars	33	14.5%
	Five cars & more	91	40.1%
Educational Level	Less than high school	4	1.8%
	High School diploma	46	20.3%
	Trade/Commerce degree	39	17.2%
	Bachelor's degree	114	50.2%
	Master's degree	19	8.4%
	PhD	5	2.2%
Employment	Public sector	121	53.3%
	Private sector	59	26.0%
	Unemployed	21	9.3%
	Self-employed	14	6.2%
	Family-owned business	12	5.3%
Field of employments	Government & Ministries	90	39.6%
	Other private services	32	14.1%
	Educations-government & private	25	11.0%
	Oil and Gas sector	23	10.1%
	Large Kuwaiti corporation	20	8.8%
	My family business	19	8.4%
	Military or police	11	4.8%
	Health Care–government & private	7	3.1%

Table 1. *Cont.*

Variable	Categories	N = 227	%
Which of the following best describes your role in industry?	Middle Management	58	25.6%
	Administrative Staff	46	20.3%
	Upper Management	29	12.8%
	Lower Management	22	9.7%
	Support Staff	15	6.6%
	Temporary Employee	12	5.3%
	Trained Professional expert	12	5.3%
	Self-employed/Business Partner	11	4.8%
	Student-Not working	7	3.1%
	Researcher	6	2.6%
	Skilled Laborer	5	2.2%
	A Consultant	4	1.8%
Monthly Income	Less than 500 KD	22	9.7%
	500–999 KD	44	19.4%
	1000–1499 KD	74	32.6%
	1500–1999 KD	50	22.0%
	2000 and above	37	16.3%

Table 2 displays the participants' perspectives on EVs. More than forty percent of respondents (41.8%) stated that they would be willing to pay an extra 6–20%, while one-third (33.5%) stated that they would pay no more than 5% more. More than one-third of participants (37.8%) would pay 6–20% extra for EVs, which they viewed as significantly faster than a corresponding ICE vehicle (0–100 km per hour in 4 s), while approximately one-fifth (19.4%) declared that they would pay nothing extra. More than 42% of participants (42.7% to be exact) indicated that they would seriously contemplate purchasing EVs if gasoline/fuel prices would go up by 50–199%, while about 18.5% were indifferent to gasoline price changes. Over 50% (54.7%) indicated that they would contemplate purchasing an EV if and only if the government controlled the prices of EVs and offered a price reduction, making them 10–30% less expensive than gasoline vehicles, whereas roughly one-fifth (18.9%) suggested that they would change their minds if the prices were comparable to gasoline vehicles. A third of participants (29.1%) would consider purchasing EVs under the condition of the availability of rapid-charging points every 10–25 km, and a quarter (24.2%) would consider purchasing EVs if there were fast-charging stations every 26–50 km.

More than half of respondents (57.7%) responded that they would reconsider purchasing an electric vehicle under the condition of the availability of a dedicated express lane located on major highways. More than 50% (53.3%) indicated that they would reconsider purchasing an EV under the condition of the availability of free public parking spaces for EVs in an amount comparable to handicapped spaces. Also, 56% said they would purchase an EV within the next three years. Of these, 14.1% suggested that they would definitely purchase an EV, while 41.9% said that they would likely do so. A total of 46.2 percent cared about the security of EVs regarding fire and accidents; 43.2% were concerned about being able to recharge their EVs around their residential areas; however, 30.8 percent stated that they would not be able to charge their EVs in their residential areas.

Table 2. Attitudes and preferences.

Question	Categories	N = 227	%
Preferred price increases for EV	0%	42	18.5%
	1–5%	34	15.0%
	6–10%	55	24.2%
	11–20%	40	17.6%
	21–29%	22	9.7%
	30% and more	34	15.0%
Preferred speed range (0–100 kmh in 4 s)?	0%	44	19.4%
	1–5%	40	17.6%
	6–10%	43	18.9%
	11–20%	43	18.9%
	21–29%	29	12.8%
	30% and more	28	12.3%
Preferred price increase brackets for gasoline cars that would push you to think of buying an EV.	500% and above	8	3.5%
	400–499%	8	3.5%
	300–399%	12	5.3%
	200–299%	22	9.7%
	100–199%	53	23.3%
	50–99%	44	19.4%
	Less than 50%	38	16.7%
	Indifferent	42	18.5%
Prefer that the government regulates and controls the purchasing costs of EVs to be _____.	30% cheaper costs than ICE cars	78	34.4%
	10% cheaper costs than ICE cars	46	20.3%
	The same costs as ICE cars	43	18.9%
	10% higher costs than ICE cars	26	11.5%
	Indifferent	34	15.0%
Preferred fast charging stations every _____.	Less than 10 km	35	15.4%
	10–25 km	66	29.1%
	26–50 km	55	24.2%
	51–75 km	28	12.3%
	76 km and more	11	4.8%
	Indifferent	32	14.1%
Prefer a fast lane dedicated to EVs on major highways (such as on highways *30* and *40*)	No	45	19.8%
	Yes	131	57.7%
	Indifferent	51	22.5%
Preferred public and free parking spaces almost at the same capacity as handicapped spaces.	No	57	25.1%
	Yes	121	53.3%
	Indifferent	49	21.6%
Are you interested on purchasing an EV in the future?	Of course, not	34	15.0%
	Unlikely	66	29.1%
	Very likely	95	41.9%
	Certainly	32	14.1%

Table 2. *Cont.*

Question	Categories	N = 227	%
Level of safety concerns regarding EVs in Kuwait, in terms of fire and car crashes	Hazardous	18	7.9%
	Unsafe	22	9.7%
	Neutral	82	36.1%
	Safe	48	21.1%
	Very Safe	57	25.1%
The possibility of charging your EVs in residential areas in Kuwait	Very impossible	38	16.7%
	Impossible	32	14.1%
	Neutral	59	26.0%
	Possible	31	13.7%
	Very possible	67	29.5%

The following scale shows:

- High agreement: with a calculated mean (M) $\geq$ 2.33;
- Medium agreement: with a calculated mean of 1.67 $\leq$ M < 2.33;
- Low agreement: with a calculated mean < 1.67.

The highest agreement among contributors (Table 3) was regarding three EV-related issues: the environmental friendliness and lower CO_2 emissions of EVs, which leads to improved quality of breathable air (M = 2.43); significantly low fuel price (M = 2.35); and a silent engine (M = 2.33). Features with moderate agreement included improved fire and collision safety (M = 2.31), quicker and better A/C conditioning (M = 2.30), significantly faster acceleration (0–100 km/h) (M = 2.20), and notably reduced maintenance costs (M = 2.19).

Table 3. The most preferred features.

Types of Attributes	The Most Preferred Features	Mean	Std
Environmental	EVs are ecofriendly with low CO_2 emissions, leading to better air quality	2.43	0.780
Financial	Lower price than petrol	2.35	0.797
Technological	Quiet engine	2.33	0.810
Technological	Raised safety concerns—crash and fire	2.31	0.788
Technological	Faster and more powerful air conditioning	2.30	0.781
Technological	Fastest acceleration (0–100 kmh)	2.20	0.804
Financial	Lower maintenance and repair costs	2.19	0.856

Regarding the perceptions of EV purchasing, as indicated in Table 4, the sample highly agreed on the following five conditions: the preferred range of fully charged EVs should be at least 400 km (M = 2.40), the preferred battery guarantee should remain 10 years at least or after 150,000 km (M = 2.39), fast-charging stations must be located within a 5 km radius (M = 2.38), and preference of the coolness and uniqueness of EV designs (M = 2.38); the remaining preferred requirements had moderate agreement, such as spotting a change in air quality once people started to drive EVs (M = 2.32); preferred price ranges should be similar or equivalent to a gasoline car (M = 2.31); purchasing an EV if gasoline prices would increase threefold (M = 2.28); distinct lanes dedicated to EVs on motorways (M = 2.26); that a majority of respondents' friends or family would purchase an EV (M = 2.02).

Table 4. Perceptions regarding EV purchase (N = 227).

Attributes	The Preferred Criteria for Purchasing an EV	Mean	SD
Technological	The driving range of a fully charged EV should be min. 400 km	2.40	0.759
Financial	Battery guarantee should remain 10 years at least or after 150,000 km	2.39	0.770
Infrastructure	Fast-charging stations should be located within a 5 km radius	2.38	0.751
Brand	Coolness and uniqueness of design	2.34	0.767
Financial	Resale value should be on par with or higher than an ICE car	2.33	0.770
Social attributes—pro-environmental	Improvement in air quality	2.32	0.779
Financial	Price should be the same or lower than a gasoline car	2.31	0.832
Financial	Gasoline prices would increase three-fold	2.28	0.809
Infrastructure	Distinct EV lanes located on motorways	2.26	0.790
Social acceptance	Family and friends would buy an EV	2.02	0.801

6. Discussion

The proposed study investigated the attitudes, preferences, and needs of fuel-vehicle drivers regarding EVs. Intriguingly, the study discovered that more than half suggested that they preferred to purchase an electric vehicle over the period of the next three years. Respondents provided the following four conditions: (i) the policymakers and government should regulate and mitigate the cost of electric vehicles by 10 to 30 percent to make them more affordable than gasoline vehicles; (ii) public fast recharging points and facilities should be accessible and spread out at least within a 10 to 50 km radius everywhere in Kuwait; (iii) specific EV fast lanes should be available on the most congested freeways.

Consequently, these findings suggest that potential EVs drivers viewed Kuwaiti regulators as playing a crucial role in promoting EVs' reputation and recognition by planning appropriate EV transportation infrastructure and establishing policies for regulating prices. Intriguingly, our results largely mirror the results of prior research conducted for various nations. In addition, nearly 40 percent of respondents suggested that they contemplated purchasing EVs if gasoline prices increased by 50 to 199 percent in the future, recognizing that EVs are still safer during fires and accidents.

Furthermore, more than a third of respondents suggested that they were willing to pay 6 to 20 percent more for EVs than for petroleum vehicles, believing that EVs are more environmentally friendly and speedier than gasoline vehicles. This intriguing finding suggests that people in Kuwait prefer EVs to petroleum vehicles because EVs offer greater environmental, economic, and technological benefits. Similar results have been found in various countries. However, about a third of residents (mainly expats) in Kuwait's residential locations are unable to charge electric vehicles. This implies that infrastructure for charging EVs must be nearby and readily available in all Kuwaiti inhabited zones. In addition, drivers favored three distinct types of EV attributes, including environmental attributes (i.e., ecological; low CO_2 emissions, which improves air quality), financial or economic attributes (i.e., much cheaper fuel price than gasoline), and technological attributes (i.e., soundless engine), which concurs with this intriguing finding.

By contrast, the current Kuwaiti ICE drivers' sample would apparently be willing to acquire EVs within the near future because they believe that EVs' technological attributes (i.e., driving range might be at least 400 km), financial or economic attributes (i.e., battery guarantee lasts 10 years or more or 150,000 km; resale EV value should be similar to or higher than fueled vehicles), and infrastructure attributes (rapid-recharging points within 5 km) could justify it. This finding suggested that the current Kuwaiti ICE drivers' sample may acquire EVs in the near future if four criteria were met: the batteries' affordability and resale value, the infrastructure's proximity of fast-charging stations, the technological features' range, and the brands with cool and attractive designs. These findings are consistent with previous cases from various nations.

While the current study provides a broader perspective on the EV phenomenon in Kuwait, it does have some limitations. Because it lacks emphasis on empirical testing to

provide clearer conclusions about the population, the findings are primarily descriptive and furthermore based on stated (rather than revealed) preferences. Therefore, future research should employ hypothesis testing to reach a definitive general inference in Kuwait. Second, additional research must employ in-depth investigations with existing EV possessors to investigate any obstacles, identify any future opportunities, and identify favorable EV characteristics and preferred designs. One suggestion is to use a focus group to obtain a more complete image of the desired features and services, as well as to determine the most effective incentives for purchasing EVs in Kuwait and the MENA region. In addition, comparative studies from various GCC regions may be of interest because the regions operate under a similar legal and economic umbrella. Lastly, additional research should investigate the management perspectives of car dealerships in Kuwait in order to examine the obstacles that are delaying the adoption and sustained mobility models for electric vehicles (EVs), clarify ambiguity surrounding EV adoptions in Kuwait, and provide a better explanation and rationale for the reluctance to replace conventional vehicles.

7. Conclusions and Implications

Other than eliminating all government subsidies for water, electricity, and petroleum, the mass transition from ICEs to EVs is the most effective strategy for reducing Kuwait's carbon footprint if EVs are charged with electricity from renewable energy sources. However, due to a total lack of rapid-charging EV stations (direct current to direction current, DC2DC) and Kuwaiti landlords not permitting the installation of EV charging-wall receptacles, ICE to EV transition is only an option for Kuwaiti citizens who own their homes. Due to a backlog of orders and formal tendering processes in Kuwait, it will take up to four years to construct an effective fast-charging station network. This study has therefore focused predominantly on Kuwaiti nationals' stated preferences and attitudes toward electric vehicles. The current study presented substantial evidence and diversified stakeholder perspectives for the emerging market of Kuwait. The main goal here is to investigate the sustainability of EVs. The outcome showed that potential Kuwaiti customers anticipate purchasing an EV within the near future—three years—but only under specified criteria, such as the availability and readiness of appropriate infrastructure such as recharging facilities, rapid roads, and free public parking. In addition, they were willing to purchase EVs and strongly preferred EVs for their ecological, economical, and technological attributes, but only under four conditions: battery cost and resale value, accessible fast-recharging facilities (infrastructure), technological features in terms of range per full charge, and brand value and appealing design.

In light of the preceding findings, the existing investigation has both theoretical and practical implications. Theoretically, the present research supports the scant literature on sustainable mobility in developing nations, particularly MENA-GCC and Kuwait. The findings could facilitate broader comparisons and more accurate assessments for developing nations, including those in the MENA-GCC region. In practice, the results of this study indicate that Kuwaitis prefer EVs over petroleum vehicles because EVs offer environmental advantages, economic benefits, and technological advantages. Consequently, vehicle dealership marketing campaigns should emphasize the utility of electric vehicles (EVs) when promoting EVs to their target markets, vehicle commuters and vehicle proprietors. In addition, the results indicate that Kuwaitis may be prepared to purchase EVs if and only if infrastructure related to the availability of rapid recharging stations and facilities, fast traffic lanes, and free parking spaces is in place. Hence, policymakers and government regulators are encouraged to initiate the construction of infrastructure to facilitate the rapid acceptance of electric vehicles in the country.

EVs offer substantial environmental benefits that contribute to promoting the use of renewable energy, reducing both urban air pollution and greenhouse gas (GHG) emissions, and thereby reducing human health hazards associated with GHG exposure. Therefore, we propose that the government execute knowledge policies to promote knowledge plan to better teach the people of Kuwait about preservation of the environment and sustainability

issues. In addition, we propose for the policymakers in Kuwait to provide sponsorship and funding programs along with other financial assistance to EV purchasers to prevent the high price of EVs. Moreover, the government should construct accessible and appropriate infrastructure, including a wide network of recharging facilities. Thus, consumers could refuel their EVs from renewable sources of energy and prevent their EVs from running out of electricity. Additionally, highways should be enhanced and better developed for EV drivers than previously.

The study results indicate that Kuwaitis might purchase EVs in the future if infrastructure regarding rapid recharging stations were readily available and easily accessible. Therefore, policymakers must construct and provide these stations to promote the adoption of electric vehicles. Kuwaitis would apparently purchase EVs for economic reasons, particularly regarding battery life and resale value. Therefore, manufacturers of electric vehicles should develop heat-tolerant longer-lasting batteries. As Kuwaitis would apparently purchase EVs due to technological attributes relating to range per complete charge and brand attributes, manufacturers should attempt to design EVs with these characteristics. As EVs are very efficient in generating energy from the source to the wheels and efficient as a tool to reduce greenhouse gas emissions as well as other forms of air pollution, the automobile industry should gradually shift toward their implementation.

Author Contributions: A.O. is the project's Principal Investor (PI) and is responsible for its conception, methodology, and editing, as well as the acquisition and administration of funds. S.B. and B.A. were accountable for the literature review, conceptualization, synthesis, methodology, validation, formal analysis, data curation, writing preparation of the original document, and editing. All authors have read and agreed to the published version of the manuscript.

Funding: This paper is a part of wider study called "Breaking the ICE reign: mixed method study of attitudes towards buying and using EVs in Kuwait". The study was funded by the Kuwait Foundation for the Advancement of Sciences and administrated by the London School of Economics and Political Science—Middle East Center (Grant number KFAS-MEC LSE 2021 001), and received an LSE Research Ethics Committee approval.

Institutional Review Board Statement: This study has been approved by the London School of Economics and Political Science Ethics Committee (00558000004KJE9AAO, dated 24 November 2021). Consent Form Statement: As directed by the LSE Ethics Committee, an informed statement about the utilization and purpose of the study was included in the questionnaire.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Ottesen, A.; Toglaw, S.; AlQuaoud, F.; Simovic, V. How to Sell Zero Emission Vehicles when the Petrol is almost for Free: Case of Kuwait. *J. Manag. Sci.* **2022**, *9*, 1–20. [CrossRef]
2. Ottesen, A.; Banna, S.; Alzougool, B.; Damrah, S. *A Greener Kuwait—How Electric Vehicles Can Lower CO_2 Emissions*; LSE Middle East Center Kuwait Programme Paper Series 18; LSE Middle East Centre: London, UK, 2023; pp. 1–21. Available online: http://chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://eprints.lse.ac.uk/120091/1/A_greener_Kuwait_paper_series_18.pdf (accessed on 10 August 2013).
3. Ottesen, A.; Thom, D.; Bhagat, R.; Mourdaa, R. Learning from the Future of Kuwait: Scenarios as a Learning Tool to Build Consensus for Actions Needed to Realize Vision 2035. *Sustainability* **2023**, *15*, 7054. [CrossRef]
4. Djoundourian, S.S. Response of the Arab world to climate change challenges and the Paris agreement. *Int. Environ. Agreem. Politics Law Econ.* **2021**, *21*, 469–491. [CrossRef]
5. Sharp, D.S.; Alshamari, A.; Hameed, K. *The Quiet Emergency: Experiences and Understandings of Climate Change in Kuwait*; LSE Middle East Center Kuwait Programme Paper Series 13; LSE Middle East Centre: London, UK, 2021; Available online: http://eprints.lse.ac.uk/112491/3/The_Quiet_Emergency.pdf (accessed on 6 June 2023).
6. New Kuwait. Kuwait National Development Plant 2020–2025. 2019. Available online: https://media.gov.kw/assets/img/Ommah22_Awareness/PDF/NewKuwait/Revised%20KNDP%20-%20EN.pdf (accessed on 26 August 2023).
7. Energy Strategy: Technical Paper Summary. In *4th Kuwait Master Plan: 2040 Toward A Smart State*; Municipality of Kuwait: Kuwait City, Kuwait, 2021; p. 65.
8. Ottesen, A.; Banna, S. Why so few EVs are in Kuwait and how to amend it. *Int. J. Eng. Technol.* **2021**, *10*, 181–189. [CrossRef]

9. Navfal, M. (KIA Kuwait, Kuwait City, Kuwait). Personal communication, 2023.
10. InsideEV Norway. Plug-In Car Sales Exceeded 90% Share in June 2023. Available online: https://insideevs.com/news/675163/norway-plugin-car-sales-june2023/#:~:text=New%20passenger%20plug%2Din%20car,more%20substantial%20growth%20over%202022 (accessed on 11 September 2023).
11. Norway Electric Vehicle Association. EV Norway. 2023. Available online: https://elbil.no/english/about-norwegian-ev-association/ (accessed on 11 September 2023).
12. ChargedKW. Charging Station Location. 2023. Available online: https://www.chargedkw.com/where-to-charge (accessed on 11 September 2023).
13. Ottesen, A.; Banna, S.; Alzougool, B. Attitudes of Drivers towards Electric Vehicles in Kuwait. *Sustainability* **2022**, *14*, 12163. [CrossRef]
14. Central Statistical Bureau. Kuwait Number of Register Vehicles in Use. 2021. Available online: https://www.ceicdata.com/en/kuwait/number-of-registered-vehicles/no-of-registered-vehicles-in-use#:~:text=The%20data%20reached%20an%20all,Global%20Database\T1\textquoterights%20Kuwait%20%E2%80%93%20Table%20KW (accessed on 6 June 2023).
15. Ottesen, A.; Banna, S.; Alzougool, B. How to Cross the Chasm for the Electric Vehicle World's Laggards—A Case Study in Kuwait. *World Electr. Veh. J.* **2023**, *14*, 45. [CrossRef]
16. Abu Dagga, N. E-Mobility—Electric Vehicles Technology and Innovation. In Proceedings of the Presentation at Australian University, Technology Leading to Sustainability—The Future of Mobility, West Misref, Kuwait, 8 May 2023.
17. Anagnostopoulou, E.; Bothos, E.; Magoutas, B.; Schrammel, J.; Mentzas, G. Persuasive technologies for sustainable mobility: State of the art and emerging trends. *Sustainability* **2018**, *10*, 2128. [CrossRef]
18. Apostolaki-Iosifidou, E.; Codani, P.; Kempton, W. Measurement of power loss during electric vehicle charging and discharging. *Energy* **2017**, *127*, 730–742. [CrossRef]
19. Geng, J.; Gao, S.; Sun, S.; Liu, Z.; Zhao, F.; Hao, H. Potential of electric vehicle batteries second use in energy storage systems: The case of China. *Energy* **2022**, *253*, 124159. [CrossRef]
20. Electrek. This Solar + Storage System is Made Up of 1300 Second Life EV Batteries. 2023. Available online: https://electrek.co/2023/02/07/this-solar-storage-system-is-made-up-of-1300-second-life-ev-batteries/ (accessed on 26 August 2023).
21. McKinsey & Company. ESG Report—Creating a More Sustainable, Inclusive and Growing Future for All. 2022. Available online: https://www.mckinsey.com/about-us/social-responsibility/esg-report-overview (accessed on 26 August 2023).
22. Cole, W.; Frazier, A.W.; Augustine, C. *Cost Projections for Utility-Scale Battery Storage: 2021 Update*; National Renewable Energy Laboratory: Golden, CO, USA, 2021. Available online: https://www.nrel.gov/docs/fy21osti/79236.pdf (accessed on 26 August 2023).
23. Li-Cycle Company. A Unique and Dependable Approach to Solving the Global Battery Cycling Problem. 2023. Available online: https://li-cycle.com/technology/ (accessed on 26 August 2023).
24. Koestner, J. 6 Thing to Remember about Hydrogen vs Natural Gas. Power Engineers. Available online: https://www.powereng.com/library/6-things-to-remember-about-hydrogen-vs-natural-gas (accessed on 7 June 2023).
25. Conti, M.; Kotter, R.; Putrus, G. Energy Efficiency in Electric and Plug-in Hybrid Electric Vehicles and Its Impact on Total Cost of Ownership. In *Electric Vehicle Business Models*; Beeton, D., Meyer, G., Eds.; Lecture Notes in Mobility; Springer: Cham, Switzerland, 2015. [CrossRef]
26. Economist. How the Japan Is Losing the Global Electric-Vehicle Race. 2023. Available online: https://www.economist.com/asia/2023/04/16/how-japan-is-losing-the-global-electric-vehicle-race (accessed on 8 June 2023).
27. American Public Transportation. Public Transportation Fact Book. 2022. Available online: https://www.apta.com/research-technical-resources/transit-statistics/public-transportation-fact-book/ (accessed on 7 June 2023).
28. IEA. Global EV Outlook 2023. 2023. Available online: https://www.iea.org/reports/global-ev-outlook-2023 (accessed on 8 June 2023).
29. BloombergNEF. Electric Vehicle Outlook 2022. 2022. Available online: https://bnef.turtl.co/story/evo-2022/page/7/1 (accessed on 6 June 2023).
30. Munoz, J.F. Tesla Model Y World Best-Selling Car for Q1 2023. 2023. Available online: https://www.motor1.com/news/669135/tesla-model-y-worlds-best-selling-car-q1-2023/ (accessed on 27 August 2023).
31. Poornesh, K.; Nivya, K.P.; Sireesha, K. A Comparative study on Electric Vehicle and Internal Combustion Engine Vehicles. In Proceedings of the 2020 International Conference on Smart Electronics and Communication (ICOSEC), Trichy, India, 10–12 September 2020; pp. 1179–1183. [CrossRef]
32. Office of Energy Efficiency and Renewable Energy. Battery Electric Vehicles Have Lower Scheduled Maintenance Cost than Other Light-Duty Vehicles. 2021. Available online: https://www.energy.gov/eere/vehicles/articles/fotw-1190-june-14-2021-battery-electric-vehicles-have-lower-scheduled (accessed on 27 August 2023).
33. Forbes. By The Numbers: Comparing Electric Car Warranties. 2022. Available online: https://www.forbes.com/sites/jimgorzelany/2022/10/31/by-the-numbers-comparing-electric-car-warranties/?sh=4c832c553fd7 (accessed on 14 February 2023).
34. J.D. Power. How Long Do Electric Battery Last? 2022. Available online: https://www.jdpower.com/cars/shopping-guides/how-long-do-electric-car-batteries-last#:~:text=Generally%2C%20electric%20vehicle%20batteries%20last,not%20pair%20well%20with%20EVs (accessed on 17 June 2023).
35. EVBox. How Long Do Electric Car Battery Last? 2022. Available online: https://blog.evbox.com/uk-en/ev-battery-longevity#:~:text=According%20to%20current%20industry%20expectations,is%20nearly%20imperceptible%20to%20drivers (accessed on 17 June 2023).

36. Monta. See How Temperature Affects the Range of Your EV. 2023. Available online: https://monta.com/uk/blog/how-temperature-affects-ev-range/#:~:text=On%20average%2C%2021.5%20degree%20celsius,used%20to%20move%20the%20car (accessed on 11 September 2023).
37. RethinkX. Rethinking Transportation—Cost and Speed of Adoption. 2023. Available online: https://www.rethinkx.com/fullsummary (accessed on 17 June 2023).
38. Hamwi, H.; Alasseri, R.; Aldei, S.; Al-Kandari, M. A Pilot Study of Electrical Vehicle Performance, Efficiency, and Limitation in Kuwait's Harsh Weather and Environment. *Energies* **2022**, *15*, 7466. [CrossRef]
39. Hamwi, H.; Rushby, T.; Mahdy, M.; Bahaj, A.S. Effects of High Ambient Temperature on Electric Vehicle Efficiency and Range: Case Study of Kuwait. *Energies* **2022**, *15*, 3178. [CrossRef]
40. United States Official Website of the International Trade Administration. Qatar Electric Vehicles Challenges and Opportunities. 2022. Available online: https://www.trade.gov/market-intelligence/qatar-electric-vehicles-challenges-and-opportunities#:~:text=Qatar\T1\textquoterights%20EV%20strategy%20aims%20to,in%20motion%20in%20September%202021 (accessed on 24 April 2023).
41. Central Statistical Bureau. Kuwait Voluntary National Review. 2019 Report on the Implementation of 2030 High Level Political Forum on Sustainable Development. Available online: https://www.arabdevelopmentportal.com/publication/kuwait-voluntary-national-review (accessed on 20 August 2022).
42. Gulf Times. Kahramaa to Set Up 150 Electric Charging Stations in 2023—EV Charging Station Network to Be Expanded to about 1000 by 2025. January 2023. Available online: https://www.gulf-times.com/article/653048/qatar/kahramaa-to-set-up-150-electric-charging-stations-in-2023 (accessed on 25 April 2023).
43. Ottesen, A.; Banna, S.; Alzougool, B. Women Will Drive the Demand for EVs in the Middle East over the Next 10 Years. *Energies* **2023**, *16*, 3756. [CrossRef]
44. The Peninsula. Qatar Converts 25% Public Transit Fleet to Eco-Friendly Mode. 19 September 2022. Available online: https://thepeninsulaqatar.com/article/19/09/2022/qatar-converts-25-public-transit-fleet-to-eco-friendly-mode (accessed on 25 April 2023).
45. The Peninsula. QatarEnergy Announces Petrol and Diesel Prices for March 2023. 28 February 2023. Available online: https://thepeninsulaqatar.com/article/28/02/2023/qatarenergy-announces-petrol-and-diesel-prices-for-march-2023#:~:text=Premium%20petrol%20will%20cost%20QR,and%20diesel%20will%20cost%20QR2 (accessed on 25 April 2023).
46. Alrajhi, J.M.; Alardhi, M.; Alhaifi, K.K.; Alkhulaifi, K.; Khalfan, A.; Alhaifi, N.A.; Alazemi, J. Prediction of Electric Vehicle Charging Stations Distribution in Kuwait. *Int. J. Traffic Transp. Eng.* **2023**, *12*, 5–9. [CrossRef]
47. Kuwait Voluntary National Review. Report on the Implementation of the 2030 Agenda to the UN High-Level Political Forum on Sustainable Development, Retrieved 12.24.2021 [Online]. 2019. Available online: https://sustainabledevelopment.un.org/content/documents/23384Kuwait_VNR_FINAL.PDF (accessed on 25 April 2023).
48. Ottesen, A.; Banna, S.; Alzougool, B.; Simovic, V. Driving factors for women's switch to electric vehicles in conservative Kuwait. *J. Women's Entrep. Educ.* **2022**, *3*, 1–21. [CrossRef]
49. Contestabile, M.; Turrentine, T. Introduction: Understanding the Development of the Market for Electric Vehicles. In *Who's Driving Electric Cars: Understanding Consumer Adoption and Use of Plug-in Electric Cars*; Springer: Cham, Switzerland, 2020; pp. 1–8.
50. Zhang, Q.; Li, H.; Zhu, L.; Campana, P.E.; Lu, H.; Wallin, F.; Sun, Q. Factors influencing the economics of public charging infrastructures for EV—A review. *Renew. Sustain. Energy Rev.* **2018**, *94*, 500–509. [CrossRef]
51. Zhang, X.; Bai, X.; Shang, J. Is subsidized electric vehicles adoption sustainable: Consumers' perceptions and motivation toward incentive policies, environmental benefits, and risks. *J. Clean. Prod.* **2018**, *192*, 71–79. [CrossRef]
52. Colak, M.; Kaya, I. providing the spark: Impact of financial incentives on battery electric vehicle adoption. *J. Environ. Econ. Manag.* **2020**, *98*, 102255.
53. Li, W.; Long, R.; Chen, H.; Geng, J. A review of factors influencing consumer intentions to adopt battery electric vehicles. *Renew. Sustain. Energy Rev.* **2017**, *78*, 318–328. [CrossRef]
54. Lia, F.; Molina ETimmermans, H.; Wee, B.V. Consumer preferences for business models in electric vehicle adoption. *Transp. Policy* **2019**, *73*, 12–24. [CrossRef]
55. Liao, F.; Molin, E.; Wee, B.V. Consumer preferences for electric vehicles: A literature review. *Transp. Rev.* **2017**, *37*, 252–275. [CrossRef]
56. Lin, B.; Wu, W. Why people want to buy electric vehicle: An empirical study in first-tier cities of China. *Energy Policy* **2018**, *112*, 233–241. [CrossRef]
57. Archsmith, J.; Muehlegger, E.; Rapson, D. Future Paths of Electric Vehicle Adoption in the United States: Predictable Determinants, Obstacles and Opportunities. *Environ. Energy Policy Econ.* **2022**, *3*, 71–110. [CrossRef]
58. Kongklaew, C.; Phoungthong, K.; Prabpayak, C.; Chowdhury, M.S.; Khan, I.; Yuangyai, N.; Yuanngyai, C.; Techato, K. Barriers to electric vehicle adoption in Thailand. *Sustainability* **2021**, *13*, 12839. [CrossRef]
59. Haider, S.W.; Zhuang, G.; Ali, S. Identifying and bridging the attitude behavior gap in sustainable transportation adoption. *J. Ambient. Intell. Humaniz. Comput.* **2019**, *10*, 3723–3738. [CrossRef]
60. Kim, S.; Choi, J.; Yi, Y.; Kim, H. Analysis of Influencing Factors in Purchasing Electric Vehicles Using a Structural Equation Model: Focused on Suwon City. *Sustainability* **2022**, *14*, 4744. [CrossRef]
61. Ziemba, P. Multi-criteria approach to stochastic and fuzzy uncertainty in the selection of electric vehicles with high social acceptance. *Expert Syst. Appl.* **2021**, *173*, 114686. [CrossRef]

62. Vilchez, J.; Harrison, G.; Kelleher, L.; Smyth, A.; Thiel, C. *Quantifying the Factors Influencing People's Car Type Choices in Europe*; Publications Office of the European Union: Luxembourg, 2017; p. 18. Available online: ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/quantifyingfactors-influencing-people-s-car-type-choices-europe-results-stated-preference (accessed on 8 June 2023).
63. Temple, J. Lithium-Metal Batteries for Electric Vehicles. MIT Technology Review. 2021. Available online: www.technologyreview.com/2021/02/24/1018102/lithium-metal-batteries-electric-vehicle-car/ (accessed on 8 June 2023).
64. Kowalska-Pyzalska, A.; Michalski, R.; Kott, M.; Skowrońska-Szmer, A. Consumer preferences towards alternative fuel vehicles. Results from the conjoint analysis. *Renew. Sustain. Energy Rev.* **2022**, *155*, 111776. [CrossRef]
65. Chao Ma, S.; Fan, Y.; Guo, J.F.; Xu, J.H.; Zhu, J. Analysing online behaviour to determine Chinese consumers' preferences for electric vehicles. *J. Clean. Prod.* **2019**, *229*, 244–255.
66. Bell, E.; Bryman, A.; Harley, B. *Business Research Methods*; Oxford University Press: Oxfor, UK, 2018.
67. Hunter, Pamila, Margin of Error and Confidence Levels Made Simple. 2010. Available online: https://www.isixsigma.com/sampling-data/margin-error-and-confidence-levels-made-simple/ (accessed on 7 July 2023).