

Article

Kuwaiti EV Owners' Experience and Recommendations for Mass Adoption for the World's EV Laggard

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Abstract: As of the end of 2024, there are only about 781 electric vehicles (EV) on the streets of Kuwait, ranking it at about the 0.03 percentile of the total car population and as the country with the lowest EVitization worldwide. In this study, we explore the reasons behind this ultra-low adoption rate from a variety of standpoints: 1. from a qualitative perspective based on deep interviews with 10 existing EV owners in Kuwait; 2. from the perspective of marketing and of capital and operational expenses by gathering the latest data from the common database of Kuwaiti automobile dealers; 3. from the perspective of governmental incentives and infrastructural development; and 4. from the technical perspective on how EVs perform in extreme heat conditions, such as those in Kuwait. From these four perspectives, we gather several reasons for the ultra-low adoption rate, and we provide a variety of possible solutions that are likely to increase the rate at which Kuwaiti residents replace their internal combustion engine automobiles with electric vehicles and, thus, lower their carbon footprint, which is one of the highest in the world.

Keywords: electric vehicles (EVs); EV ownership experience; early majority preferences; EV sales perditions



Received: 19 January 2025

Revised: 13 February 2025

Accepted: 18 February 2025

Published: 21 February 2025

Citation: Ottesen, A.; Navfal, M.; Hamwi, H.; Kous, A.A. Kuwaiti EV Owners' Experience and Recommendations for Mass Adoption for the World's EV Laggard. *World Electr. Veh. J.* **2025**, *16*, 117. <https://doi.org/10.3390/wevj16030117>

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1. Introduction

1.1. Relevance

This study is the ninth and final one in a series of published papers based on 3 years of research sponsored by the Kuwait Research Council and the Kuwait Foundation for the Advancement of Science and managed by the Middle East Centre of the London School of Economics and Political Science [1–8]. The name of the study is “Breaking the ICE reign: a mixed-methods study of the socio-behavioral dimensions of transitioning to EVs in Kuwait”. Achieving the long-term sustainability of Kuwaiti society and the environment through science, technology, and innovation is the main vision of KFAS, and the sustainable usage of water, land, air, and energy is at its core. Although it is still among the highest carbon emitters in the world, Kuwait has managed to lower its carbon footprint per capita in comparison with that of a few years ago. In 2023, Kuwait's carbon dioxide (CO₂) emissions were significantly influenced by various sectors—notably, electricity consumption, of which 65–70% was used for indoor cooling, fuel exploitation, industrial combustion, transportation, and additional industrial operations. CO₂ emissions from electricity used

in indoor cooling alone constitute about 32% of the total greenhouse gas emissions. This substantial contribution is largely driven by Kuwait's extreme summer temperatures, often surpassing 50 °C, necessitating elevated air conditioning usage. Fuel exploitation accounts for 19% of emissions, and this pertains to the processes involved in oil extraction, refining, and processing, thereby highlighting Kuwait's reliance on hydrocarbon resources [9].

Industrial combustion contributes 15% to overall emissions, resulting from energy-intensive manufacturing and industrial activities. Other forms of electricity consumption, encompassing residential, commercial, and non-cooling industrial usage, account for 14%, which is comparable to the 14% attributed to the transportation sector, where there is a pronounced dependence on fossil-fuel-powered vehicles. Lastly, miscellaneous industrial operations contribute an additional 6% to total emissions; see Figure 1 [9].

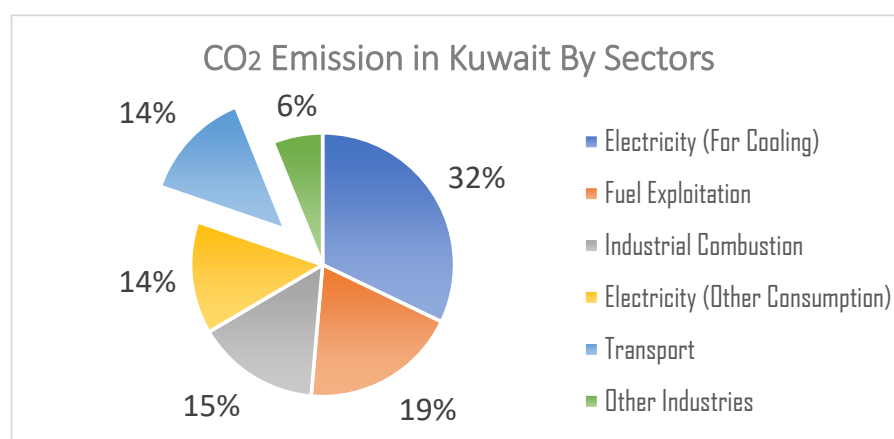


Figure 1. Source: CO₂ emissions in Kuwait by sector (2023). Source: European Commission—Joint Research Centre, data source from Ref. [9].

The energy framework within Kuwait is characterized by a high degree of unsustainability, as the energy sources are non-renewable. Notably, power generation is exclusively reliant on fossil fuels, with 59% being derived from oil and 41% from natural gas [10].

Kuwait's per-capita carbon dioxide (CO₂) emissions in 2021 were recorded at 20.5 tonnes per person, placing the nation among the highest global emitters and substantially surpassing the European Union average of 7 tonnes per person [11]. Within the Gulf Cooperation Council (GCC) region, Kuwait stands as one of the leading contributors to carbon emissions, trailing behind only Qatar (38.8), Bahrain (23.3), Saudi Arabia (22.1), and the United Arab Emirates (21.6), while Oman (15.5) reports the lowest emissions in the region. In comparison, European countries such as Poland (7.5) and Germany (7.1) exhibit notably lower per-capita emissions, with France (4.1), the United Kingdom (4.4), Spain (4.6), and Italy (5.3) showcasing even more significant advancements in emission reductions. The considerable CO₂ emissions in Kuwait can primarily be attributed to its dependency on fossil fuels for energy production, elevated per-capita energy consumption, and the high demand for cooling due to the extreme climatic conditions; see Table 1 [12].

A prominent factor contributing to Kuwait's carbon emissions is the transportation sector, which heavily relies on gasoline-powered vehicles. The adoption of electric vehicles (EVs) represents a crucial strategy for Kuwait in reducing its carbon footprint since the transport sector is a major source of greenhouse gas emissions. European nations that have effectively reduced their per-capita emissions have done so in part by developing EV infrastructure, providing financial incentives for EV adoption, and implementing stringent emission regulations. In contrast, Kuwait has yet to develop a comprehensive framework for EV adoption, including the necessary charging infrastructure and policy incentives to facilitate a transition toward sustainable transportation [13–15].

Table 1. CO₂ emissions per capita in metric tons in 2023, data source from Ref. [12].

GCC Countries	CO ₂ Emissions (per Capita 2023) (Tonnes per Person)	Largest European Countries	CO ₂ Emission (per Capita 2023) (Tonnes per Person)
Qatar	38.8	Poland	7.5
Bahrain	23.3	Germany	7.1
KSA	22.1	Italy	5.3
UAE	21.6	Spain	4.6
Kuwait	20.5	UK	4.4
Oman	15.5	France	4.1
Average	23.63	Average	5.5

1.2. Electric Vehicles in Kuwait

From January 2019 until the end of 2024, only 781 EV dealership sales were registered in Kuwait [16]. Assuming the same sales trajectory from 2010 to 2019, we estimate that only 30 EVs were sold before 2019. Several EV drivers still have foreign license plates on their EVs, especially Tesla owners, as there is no Tesla dealership in Kuwait. Tesla owners have usually purchased their EVs in neighboring countries, such as the Kingdom of Saudi Arabia or the United Arab Emirates, where Tesla has dealerships, or from other dealerships in these countries, as these dealerships offer a greater variety of EVs. We estimate that these foreign-registered EVs do not exceed 100 vehicles because of issues with insurance and registration. Hence, only around 900 EVs are thought to be currently on the streets in Kuwait, making up only 0.03 percent of the total car population of 2.5 million cars registered in Kuwait as of the end of 2024 [17]. This number is extremely low, especially in comparison with the most advanced nation in terms of EVs and a fellow oil producer, Norway, which has already replaced 25.5% of its passenger cars with EVs. That is about 900 times more than the EVs in Kuwait as of the middle of 2024 [18]. Norway's EVitization of its passenger cars has, as a result, permanently lowered its carbon footprint by 4% and led to significant improvements in air quality, a development that has yet to transpire in Kuwait [19].

1.3. Industry Insights

To gain insights into the reason as to why Kuwait has the lowest EV adoption rate in the world, we consulted Mohammed Navfal, an automotive and future mobility industry expert [20]. (Mohammed Navfal is currently working as an expert for KIA in Kuwait and formerly worked for Mazda Kuwait; here, he offered his personal opinions and not those of his employers). According to Mr. Navfal, EVs are gaining popularity as the world shifts towards a more sustainable and environmentally friendly future. Governments and automakers around the world are investing heavily in the development and production of electric vehicles, and this trend is likely to continue in the coming years. In general, the future of EVs in Kuwait and other countries will depend on several factors, including government policies, consumer preferences, and the availability of charging infrastructure. If Kuwait's government takes active steps to encourage the adoption of EVs, such as offering incentives or building charging stations, this could lead to an increase in demand for electric vehicles. In addition, automakers are continually developing new EV models with longer ranges, faster charging times, and lower prices, making electric vehicles more accessible to a wider range of consumers. This trend is likely to continue, and we can expect to see more affordable and practical electric vehicles in the market in the coming years. The pace of adoption will depend on various factors, and it will take some time for

EVs to become the dominant mode of transportation in many countries. Other EV dealers in Kuwait convey similar stories [21–26].

1.4. Governmental Push Policies

Supportive or punitive policies, practices, and regulations with direction from the national government—so-called “push strategies”—appear to be paramount when building a market for EVs. For example, with directives from its Environmental Protection Agency (EPA), the United States (US) has regulated the average fuel efficiency, and, in the case of passenger cars, the efficiency requirement increased 23% from 15.4 km/L in 2015 to 22/1 in 2025, which is equivalent to only 4.55 L per 100 km on average. Such a high average fuel efficiency target can clearly not be achieved without the use of zero-emission vehicles [27]. Since 2018, 10 US states, including Oregon and California, have required that 2% of all new cars are zero-emission vehicles (ZEVs), with a 2% increase annually from 2018, and they impose hefty penalties for violations. California is leading the way by aiming for 100% ZEVs by 2035. The People’s Republic of China implemented a four-step fuel efficiency regulation from 2016 to 2020 that increased the aggregate fuel efficiency from 14.5 km/L in 2015 to 20/L in 2020; that is, by 5 L per 100 km. China’s enforcement of its energy policy requires that 8 million units of new plug-in hybrid EVs (PHEVs), fuel-cell EVs (FCEVs), or battery EVs (BEVs) be sold annually by the year 2025 [28]. In the European Union, the European Commission issued directives that strengthened CO₂ emission requirements from 130 g/km in 2015 to 95 g/km in 2021, which was a 27% reduction [29]. However, Japan seems to be having a “Kodak moment”. (“Kodak moment” refers to the fact that the Kodak Company invented the digital camera, but they did not emphasize the technology, which later led to their demise). It was at the forefront of the use of electric hybrids, with the Toyota Prius as one of the stars, as well as the Nissan Leaf, which was one of the first hit EVs, but now, Japanese EV makers are playing catch-up to the US, China, and Europe in terms of EV adoption. One of the reasons why Japan has fallen behind is the lack of punitive and incentive governmental policy for EV owners and makers, as the Japanese government seems to have preferred hydrogen and fuel-cell cars, which received all of their attention at the expense of EVs, resulting in only 2% EVs as of the end of 2020 [30]. The following graph (Figure 2) clearly shows how Japan has fallen behind and how governmental policies with a punitive or incentive system play a role in building up a home market for EV adoption, which appears to be the foundation for exporting success. South Korea seems to mirror Japan in that governmental policies only started to push EVs in 2022. A mere 5.96% of automobiles in South Korea were considered environmentally friendly or “green”, and these included hydrogen EVs, hybrid EVs, PHEVs, and full-electric EVs. Most sales came from last year, as the sales skyrocketed due to the government pushing EVs, as well as attractive EV offerings from Hyundai/Kia [31].

According to a forecast from Bloomberg, Japan is clearly losing out, Korea is trying hard to catch up, and China is likely to rise as the winner of the EV adoption race [32]. Bloomberg also predicts that countries that have traditionally not produced cars will also enter the EV race, as, apart from their batteries, EVs are much simpler than internal combustion engine (ICE) cars because EVs only have about 20 moving parts versus over 2000 in ICE cars. Kuwait’s neighbors, the Kingdom of Saudi Arabia (KSA) and Qatar, are likely to be among these nations. KSA recently bought a controlling stake in US Lucid Motors with the intention of taking over a quarter of the production in the KSA or a total of half a million vehicles by 2030, with the first car being produced by 2025 [32]. Similarly, the Investment Promotion Agency of Qatar is exploring whether the country can be an EV manufacturing hub for the Middle East and North Africa (MENA) region in cooperation

with the German Volkswagen company and the Chinese Gaussin and Yutong companies, with whom the Qatari government has already partnered [9].

1.5. EV Plans of the Kuwaiti Government in Contrast with Neighboring Qatar

The Government of Kuwait will be required to take the initiative in the transition to zero-emission/high-voltage vehicles to replace internal combustion engine (ICE) vehicles, as stated by Mr. Navfal and other automobile dealers. The government of Kuwait has committed to taking urgent action to combat climate change and its impacts through the State of Kuwait's National Determined Contribution (NDC) to the Sustainability Goals of the United Nations and its master plan, Vision 2035, especially since Kuwait was the third-largest emitter of CO₂ in 2022, following Qatar and Bahrain [10,33,34]. The reduction that results from the transition to zero-emission vehicles is not addressed in these documents. This is in stark contrast to the neighboring country of Qatar, which, like Kuwait, has a vision of reducing its CO₂ output and is in the process of transitioning its entire public transportation system to electric vehicles. The Qatari government anticipates that the percentage of new electric vehicles (EVs) will reach 10% by 2030, in accordance with the Qatar Electric Vehicle Strategy 2021. The transition to electric vehicles (EVs) by both public and private entities will make a substantial contribution to Qatar's commitment to the Paris Agreement [35]. Qatar's government has launched several initiatives that strive to increase the ownership of EVs.

1.6. Total Lack of Fast-Charging Stations—Waiting for Solid-State Batteries

Kuwait and Qatar face similar problems in terms of public fast-charging EVs; that is, with direct current to direct current (DC to DC) at 300–500 MW. Charging in extreme temperatures presents difficulties, and the summer heat frequently exceeds 50 °C. While Kuwait is still studying this case, Qatar has taken a more active approach. According to the Kuwaiti charging equipment provider, as of August 2024, there were only 43 public charging stations, out of which 41 were slow, with around 5 h of alternative current (AC) charging stations and only two small DC stations for demonstration. The equipment provider ChargedKW estimates that this number will increase five-fold in 2 years to over 120 stations [36].

As of 2024, Qatar, which is only half of the size and population of Kuwait, had over 200 DC-to-DC stations installed, and 300 more are being put into commission, with a target of 600 fast-charging stations installed by the end of 2025 [37]. The Green Car Initiative aims to decarbonize transportation by 10% by 2030 through joint efforts of the ministries of transportation and energy by encouraging residents to switch to EVs [38]. The rapid buildup of charging stations in and around governmental offices, as well as in residential areas, homes, and nearby heavy-traffic areas, are at the heart of their plan, in addition to an educational campaign to correct common misconceptions about cost, durability, and safety concerns. Furthermore, various infrastructure programs, such as free parking spaces for EVs and charging subsidies, are also part of the Qatari plans to increase the adoption of EVs [39].

1.7. Kuwait Is Catching Up

Kuwait is watching and learning from the experience of Qatar in the efficiency, durability, and safety of fast charging in extreme temperatures. According to Abdulaziz Al Kous, a senior engineer at the Ministry of Electricity, Water, and Renewable Energy (MEWRE), ultra-fast charging stations in the Gulf region still do not reach full capacity during summer months, and there is considerably more work needed to develop fast-charging stations for extreme heat conditions; the same goes for the battery technology used in electric vehicles, as they play a crucial role in the charging efficiency in the face of climate challenges. This de-

velopment might include shaded charging facilities and air- or water-cooled fast-charging equipment (or equipment using a more efficient liquid coolant). EVs also need to be tested in at least 70 °C heat, which is the maximum heat that can occur under a vehicle depending on the battery-cooling system. (Abdulaziz Al Kous is currently working in the MEWRE on the EV regulatory approval committee; here, he offered his personal opinions and not those of his employers). From the perspective of the Kuwaiti government's movements, the MEWRE published its standards and regulations for electric vehicle chargers in 2022. Until now, it has provided more than 100 certificates for a variety of slow and fast EV chargers for many companies' providers. It also made a system where anyone can apply for an installation permit online. Since then, the MEWRE has been building a database for all types and models that are applicable to be installed in Kuwait. That will help them more efficiently study and monitor each type/model and further diagnose the challenges. Now, the MEWRE is also adopting EV chargers for installation in their new green buildings, and it is expected that this will be expanded to all of their buildings in the next few years, in addition to some additional benefits to encourage their employees to adopt electric vehicles. The MEWRE further supported the expansion of EV chargers by setting an electrical tariff for EV chargers for residential properties in Kuwait as low as 0.002 KWD/kWh, equivalent to 0.0065 USD/kWh, which is considered one of the lowest tariffs in the world. Based on the current observations and the upcoming projects, one should be optimistic about the future of EVs in Kuwait, as the market and public appeal grow larger with time [40].

However, the next generation of EV batteries might solve the problem of fast charging in extreme heat conditions. The Kuwait Institute for Scientific Research (KISR) has conducted and continues to conduct extensive research on the potential of solid-state batteries as a viable solution for withstanding the extreme temperatures typical of the Arabian Gulf region [41,42]. These types of batteries are a more thermally stable and secure alternative to lithium-ion batteries. Solid-state batteries, in contrast to liquid lithium-ion batteries, utilize solid electrolytes that may possess distinct thermal properties. Solid-state battery electrode-solid electrolyte interactions may be compromised by elevated temperatures, although they typically exhibit a lower thermal conductivity than that of liquid electrolytes. This instability may result in an increase in heat and resistance during charging and discharging. Solid electrolytes that undergo thermal degradation or reactions are particularly susceptible to this phenomenon. Certain solid electrolytes may become less stable at elevated temperatures, which can result in heat-generating side reactions in specific solid-state batteries with sulfide-based electrolytes at elevated temperatures, resulting in increased heating and safety concerns. Cooling systems are incorporated into lithium-ion batteries in high-performance applications, such as electric vehicles, to regulate heat. The potential for future applications of solid-state batteries is substantial due to their superior energy density and safety. However, to achieve widespread adoption, thermal management challenges must be resolved. Research and development are being implemented to enhance the thermal characteristics and performance of solid-state battery materials and designs [43].

1.8. Combination of EV Sales in Kuwait in the Last 6 Years: Brands and Prices

Eng. Navfal collected supply and sales data on EV sales from the Union of Automotive Agents from 2019 until the end of 2024. According to the data, the Porsche Taycan was by far the most popular EV model sold in Kuwait, which is the first difference from other countries [44]. However, the drivers of the Porsche Taycan EV are even more different from typical EV drivers worldwide, who are likely to be 30–50-year-old upper-middle-class males who are environmentally conscious, well educated, and often motivated by sustainability and cost-saving benefits [1–8]. Drivers of the Porsche Taycan EV in Kuwait are almost exclusively males in their 60s who are wealthy, as the most commonly sold Taycans

are those with the full options and a price tag of around USD 200,000. The motivation of Taycan drivers is not so much environmental concern but rather the torque for getting to 100 km in less than 2 s, making it much faster than a Ferrari or similar luxury vehicles. The owners of Taycans usually own three or more cars and use this vehicle as—for lack of a better word—more of a toy than a primary mode of transportation [2]. See Figure 2 and Attachment A for a further breakdown of the models within the brands that were sold.

After a small decline in 2020, there was consistent and rapid growth in sales each year from 2021 onward. The sales growth from 2021 to 2024 was particularly steep, with a strong increase from 89 to 226 units in just 3 years. In 2024, EVs started to take off. Mercedes led the way with the introduction of a variety of models, such as SUVs, luxury vehicles, and sedans. The preference of Kuwaiti EV drivers for power over price can clearly be seen in Table 2, where it can be seen that the average EV sold in Kuwait has an approximately 350 kW motor and over 80 kWh of battery; see also Table 3.

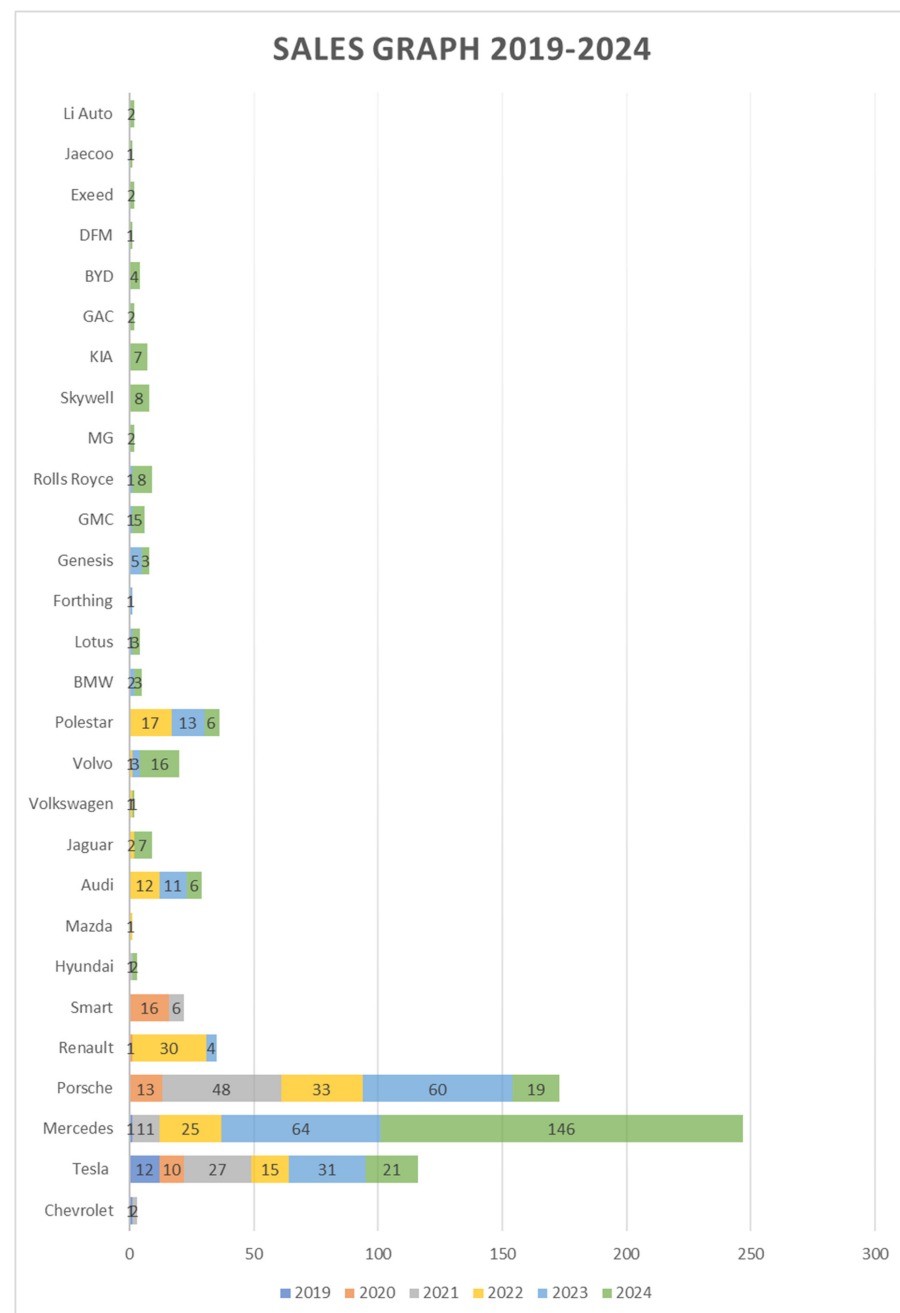


Figure 2. Sales graph for 2019–2024, data source from Ref. [45].

Table 2. The prices of EV models that are currently being sold in Kuwait, data source from Ref. [46].

EV Model	USD Price	EV Model	USD Price
Polestar 2 Single Motor	51,300	Volvo C40 Recharge Single Motor	53,300
Polestar 2 Dual Motor	57,000	Volvo C40 Recharge Dual Motor	61,000
Porsche Taycan	91,000	Volvo XC40 Recharge Single Motor	55,000
Porsche Taycan 4S	109,000	Volvo XC40 Recharge Dual Motor	60,000
Porsche Taycan GTS	136,000	Volvo EX30 Single Motor	34,950
Porsche Taycan Turbo	152,000	Volvo EX30 Dual Motor	45,000
Porsche Taycan Turbo S	194,000	Volvo EX90 Electric	79,900
Porsche Taycan 4 Cross Turismo	100,000	Cadillac Lyriq Single Motor	58,590
Porsche Taycan 4S Cross Turismo	110,000	Cadillac Lyriq Dual Motor	64,000
Porsche Taycan Turbo Cross Turismo	160,000	BYD Atto 3	38,000
Audi e-tron GT quattro	107,995	BYD Tang EV	70,000
Audi RS e-tron GT	139,900	Skywell ET 5	45,000
Audi Q8 e-tron	74,400	Hyundai Ioniq 5	41,450
Audi Q8 Sportback e-tron	89,500	Hyundai Ioniq 6	45,000
Audi SQ8 Sportback e-tron	96,000	Jaguar I-Pace R-Dynamic S	73,000
Genesis G70 Electrified	65,000	Jaguar I-Pace R-Dynamic SE	78,400
Genesis G80 Electrified	80,000	Jaguar I-Pace R-Dynamic HSE	89,500
Mercedes Benz EQE 350+	76,000	Kia EV5	50,000
Mercedes Benz EQS 450+	105,000	Kia EV6	48,500
Mercedes Benz EQS580 4Matic	126,000	Kia EV9	73,000
Mercedes Benz EQA 350 4Matic	55,000	MG 4	40,000
Mercedes Benz EQB 350 4Matic	58,000	Hummer EV3X SUV	105,000
Mercedes Benz EQE 350 4Matic	76,000	Hummer EV Edition 1 SUV	104,000
Mercedes Benz EQE 500 4Matic	96,000	Hummer EV3X Pickup	115,000
Mercedes AMG EQE 53 4Matic+	120,000	Hummer EV Edition 1 Pickup	109,000
Mercedes Benz EQS 450 4Matic	110,000	Lotus Eletre	84,000
Mercedes Benz EQS 580 4Matic	130,000	Lotus Eletre S	120,000
Mercedes Maybach EQS 680	180,000	Lotus Eletre R	145,000
Mercedes Benz EQV	70,000	Rolls Royce Spectre	558,000
Bolt EVLT	27,495	Renault Twizy	12,000
Smart Fortwo Coupe	26,740	Renault Zoe ZE40	34,000
Smart Limited 1	21,900	Mazda MX-30	33,470
Smart Fortwo Cabriolet	28,850	Volkswagen ID.4 Crozz	41,160
BMW I3s	44,450		

Table 3. Features of EVs sold in Kuwait, data source from Ref. [46].

	Brands	Power	WLTP	Battery
POLESTAR	Polestar 2 Single Motor	170 kW	478 km	69 kWh
	Polestar 2 Dual Motor	300 kW	487 km	78 kWh
PORSCHE	Porsche Taycan	300 kW	503 km	83.7 kWh
	Porsche Taycan 4S	390 kW	452 km	71 kWh
	Porsche Taycan GTS	440 kW	502 km	83.7 kWh
	PorscheTaycanTurbo	500 kW	506 km	83.7 kWh
	Porsche Taycan Turbo S	560 kW	467 km	83.7 kWh
	Porsche Taycan 4 Cross Turismo	350 kW	488 km	83.7 kWh
	Porsche Taycan 4S Cross Turismo	420 kW	488 km	83.7 kWh
	Porsche Taycan Turbo Cross Turismo	500 kW	483 km	83.7 kWh
AUDI	Audi e-tron GT quattro	350 kW	488 km	83.7 kWh
	Audi RS e-tron GT	440 kW	472 km	93.4 kWh
	Audi Q8 e-tron	250 kW	491 km	95 kWh
	Audi Q8 Sportback e-tron	300 kW	600 km	114 kWh
	Audi SQ8 Sportback e-tron	370 kW	513 km	114 kWh
GENESIS	Genesis G70 Electrified	360 kW	455 km	77.4 kWh
	Genesis G80 Electrified	272 kW	427 km	87.1 kWh
MERCEDES	Mercedes Benz EQE 350+	215 kW	654 km	90.6 kWh
	Mercedes Benz EQS 450+	245 kW	783 km	107.8 kWh
	Mercedes Benz EQS580 4Matic	385 kW	676 km	107.8 kWh
	Mercedes Benz EQA 350 4Matic	215 kW	432 km	66.5 kWh
	Mercedes Benz EQB 350 4Matic	215 kW	419 km	66.5 kWh
	Mercedes Benz EQE 350 4Matic	215 kW	558 km	90.6 kWh
	Mercedes Benz EQE 500 4Matic	300 kW	521 km	90.6 kWh
	Mercedes AMG EQE 53 4Matic+	460 kW	470 km	90.6 kWh
	Mercedes Benz EQS 450 4Matic	256 kW	596 km	108.4 kWh
	Mercedes Benz EQS 580 4Matic	400 kW	529 km	108.4 kWh
	Mercedes Maybach EQS 680	484 kW	600 km	108.4 kWh
VOLVO	Mercedes Benz EQV	150 kW	347 km	90 kWh
	VolvoC40RechargeSingle Motor	175 kW	476 km	78 kWh
	Volvo C40 Recharge Dual Motor	300 kW	533 km	78 kWh
	Volvo XC40 Recharge Single Motor	175 kW	476 km	78 kWh
	Volvo XC40 Recharge Dual Motor	300 kW	500 km	78 kWh
	Volvo EX30 Single Motor	200 kW	480 km	69 kWh
	Volvo EX30 Dual Motor	315 kW	460 km	69 kWh
	Volvo EX90 Electric	300 kW	600 km	111 kWh
CADILLAC	Cadillac Lyriq Single Motor	255 kW	500 km	102 kWh
	Cadillac Lyriq Dual Motor	373 kW	480 km	102 kWh

Table 3. Cont.

Brands		Power	WLTP	Battery
BYD	BYD Atto 3	150 kW	345 km	49.92 kWh
	BYD Tang EV	380 kW	430 km	86.4 kWh
SKYWELL	Skywell ET 5	150 kW	460 km	72 kWh
HYUNDAI	Hyundai Ioniq 5	125 kW	384 km	58 kWh
	Hyundai Ioniq 6	111 kW	429 km	53 kWh
JAGUAR	Jaguar I-Pace R-Dynamic S	294 kW	470 km	90 kWh
	Jaguar I-Pace R-Dynamic SE	294 kW	470 km	90 kWh
	Jaguar I-Pace R-Dynamic HSE	294 kW	470 km	90 kWh
KIA	Kia EV5	160 kW	530 km	82 kWh
	Kia EV6	168 kW	528 km	77.4 kWh
	Kia EV9	283 kW	541 km	99.8 kWh
MG	MG 4	150 kW	450 km	64 kWh
GMC	Hummer EV3X SUV	619 kW	482 km	200 kWh
	Hummer EV Edition 1 SUV	619 kW	482 km	200 kWh
	Hummer EV3X Pickup	745 kW	530 km	200 kWh
	Hummer EV Edition 1 Pickup	745 kW	539 km	200 kWh
LOTUS	Lotus Eletre	450 kW	600 km	112 kWh
	Lotus Eletre S	450 kW	535 km	112 kWh
	Lotus Eletre R	675 kW	450 km	112 kWh
ROLLS ROYCE	Rolls Royce Spectre	430 kW	466 km	107 kWh
CHEVROLET	Bolt EVLT	150 kW	414 km	65 kWh
RENAULT	Renault Twizy	12.6 kW	100 km	6.1 kWh
	Renault Zoe ZE40	68 kW	300 km	41 kWh
SMART	Smart Fortwo Coupe	60 kW	133 km	17.6 kWh
	Smart Limited 1	60 kW	133 km	17.6 kWh
	Smart Fortwo Cariolet	60 kW	132 km	17.6 kWh
MAZDA	Mazda MX-30	107 kW	200 km	35.5 kWh
VOLKSWAGEN	Volkswagen ID.4 Crozz	150 kW	522 km	77 kWh
BMW	BMW I3s	135 kW	285 km	42.2 kWh

The government of Kuwait did not display any preferential treatment at any time or in any form to electric vehicles or electric transport as of the end of 2024. All cars are subject to 5% import taxation, regardless of the type or shape. The price of EVs is 20–30% higher than that of ICE vehicles, which reflects the extra production cost of EV batteries. As most EVs sold in Kuwait have rather large batteries, the large price differential causes them to be compared with ICE vehicles with similar bodies; see Table 3. Comparison of the prices between EV and ICE vehicles is a bit tricky, as EV technology is fundamentally different from that of ICE vehicles. EV engines are tiny; thus, a cubic engine size comparison does not make sense. Due to their gearless power train, standard EVs have torque that is equivalent to that of the most expensive supercars. Due to the lack of moving parts in EVs, the maintenance cost is only a fraction of the maintenance cost of ICE cars. The difference

in resale value remains to be seen in Kuwait, as there is not an active market for used EVs yet. EVs sold in Kuwait are generally in a high price range. For example, a “standard” EV, such as the BYD Attos 3, starts at approximately USD 25,000, and a long-range Tesla Model 3 is around USD 45,000. In contrast, most basic passenger cars sold in Kuwait start at around USD 15,000–20,000. However, we tried to compare models from the same brand that were built on the same or similar body. The popularity of Porsche and Mercedes in Kuwait can be explained by the small price difference between EVs and ICE vehicles. For example, the standard version of the Porche Panamera and the standard version of the Porche Taycan cost virtually the same amount—around USD 100,000—and the EV is only 1.5% more expensive. The standard version of the Mercedes EQE is only 2% more expensive than the E Class vehicle. The Mercedes EQS is only 2% more expensive than the GLS. However, a greater price difference is demonstrated in other cars, such as the electric Macan, which is about 18% more expensive than the ICE Macan, and a similar situation holds for the Jaguar I Pace and E Pace, as well as other vehicles in the same category. The price differences are greater for smaller cars, where it can be up to 30% as the cost, and the size of the battery can represent more than 30% of the value of the car. Without any public financial incentive system in place, the high price differences for smaller cars effectively mean that smaller EVs are priced out of the market, which largely explains the EV model preferences. This is in stark contrast to the early-adopting nations, such as the Scandinavian countries, where EVs are even cheaper than ICE vehicles due to a variety of tax incentives, such as the removal of tariffs, value-added taxes (sales taxes), excise duties, and free toll roads for EVs [46].

1.9. Predictions of EV Sales with and Without Fast Charging Stations

The electric vehicle (EV) market has shown significant growth over the last few years, with sales increasing across various brands, as illustrated in Figure 3. However, one of the critical factors driving EV adoption is the availability of fast charging infrastructure. The data suggest that automakers such as Tesla, Porsche, and Mercedes-Benz, which have robust fast-charging networks or compatibility with existing ones, have experienced substantial growth in EV sales compared with brands with limited or slower charging solutions.

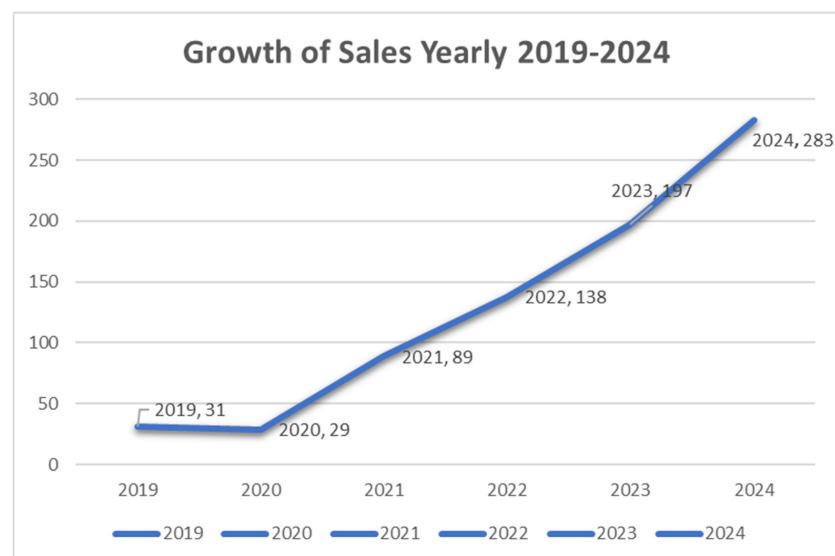


Figure 3. Source: Specifications of the most commonly sold EVs in Kuwait (Tesla is omitted, as there are no Tesla dealerships in Kuwait), data source from Ref. [42].

To express the growth of EV sales in the scenarios, we can use the following standard formula:

$$y = mx + c$$

where,

y: predicted value (EV sales in this case);

m: slope (rate of change or growth rate);

x: independent variable (time, in years);

c: intercept (initial sales at the starting point).

The following are the linear regression formulas for different scenarios.

Scenario 1: Basic EV sales growth (no additional infrastructure):

$$\text{EVsales}_t = m \cdot t + c$$

where,

m: growth rate (slope);

c: initial sales in the starting year.

Explanation: According to the data between 2019 and 2024, the sales of EVs showed a clear trend of growth. Using a linear model, the average growth rate is calculated to be around 63.5 EVs per year. Starting from 29 EVs sold in 2020, the predicted sales for 2025 are about 347 EVs, and for 2030, they are estimated to reach 664 EVs per year. This steady increase reflects a consistent rise in demand for EVs.

Scenario 2: EV sales growth with fast-charging stations:

$$\text{EVsales}_t = a \times (2^{t-t_0})$$

where,

a: the initial value (in this case, the value for 2024, which is 283);

t_0 : the reference year (in this case, 2024);

t: the year for which we would like to predict the sales;

2: the doubling factor.

Explanation: Using the formula, predictions are made for EV sales growth from 2025 to 2030, assuming that fast-charging stations will significantly boost demand. Starting with 283 EVs sold in 2024, the model shows that sales could reach 566 EVs in 2025 and grow rapidly to 18,112 EVs by 2030. This is due to the doubling effect introduced by fast-charging stations, which accelerate sales each year, as depicted in Figure 4.

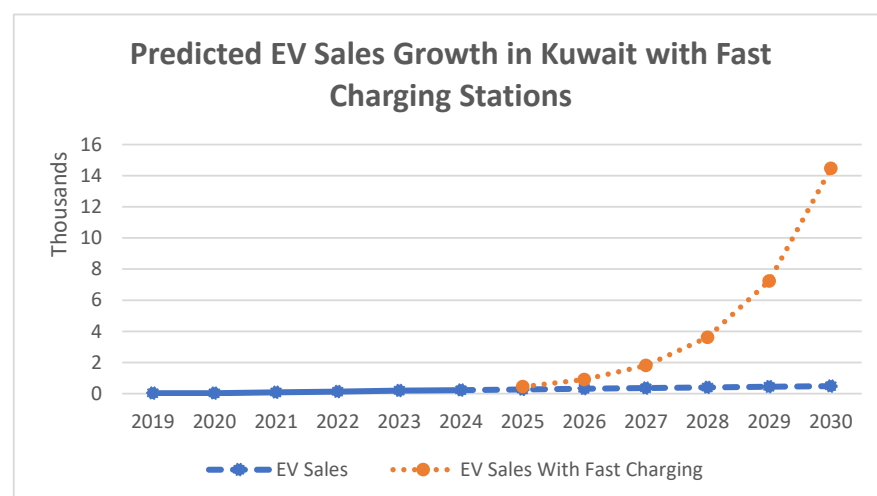


Figure 4. Predicted EV sales growth in Kuwait with fast-charging stations (2025–2030) based on qualitative interviews with dealers and owners of EVs in Kuwait.

1.10. EV Fast Lanes Between Downtown Areas and the Suburbs

The main difference among the early-adopting nations (Norway and other Scandinavian nations) is the adoption of a free fast lane, where EVs can use the fast lane for busses and taxis, and the fact that toll roads, ferries, and parking infrastructures are free of charge, mainly between the main areas of employment in the capital and the suburbs, where the majority of the population lives. This saves suburb dwellers in Oslo, the capital of Norway, not only up to 1 h per day in commuting time but also a considerable amount of money that EV drivers would otherwise have to pay. Over one-third of passenger cars in Norway are now plug-in vehicles, whereas the next country in terms of EV adoption, Iceland, has only 20%, and Sweden and Denmark have a plug-in ratio of only about 12% for all passenger cars [47]. The difference is that there are no designated EV fast lanes from the suburbs to the city centers [48,49]. Thus, it would be fair to assume that if the largest freeways from the suburbs to the city center in Kuwait, Freeway 30 and Freeway 40, had a designated fast lane for EVs, there would be a jump in demand.

2. Hypothesis and Purpose

This study bridges the gap in previous studies that were focused firstly on qualitative interviews to gain EV dealerships' perspectives and their predictions and conditions for EVs to succeed in the Kuwaiti marketplace. The next several studies were concentrated on large surveys about the preferences of early adopters of EVs and the conditions under which their next car would be an EV. The third type of study focused on technical aspects, such as batteries and charging stations that can tolerate the extreme heat conditions in Kuwait at full capacity. The final study in this series captured the experience of EV owners in Kuwait, their pain and gains in owning and operating EVs, and their recommendations to leaders and policymakers on what changes need to occur if EVs are to become mainstream.

This qualitative and exploratory investigation is meant to capture the perspectives of EV owners and to demonstrate the importance of governmental policy, strategy, and implementation, such as installing fast-charging stations to break the path dependency of ICE vehicles for the benefit of the environment in terms of the lowering of CO₂ emissions and the improvement of air quality. This is followed up by in-depth interviews to investigate the attitudes of 10 Kuwaiti EV owners toward EV use and to document their ownership experiences. From the interviews, we gathered valuable insights into how to proceed with promoting the EVitization of transport in Kuwait. Finally, we describe our projection of who will be likely to buy EVs (customer groups) soon in Kuwait and in what quantity due to (a) no policy change or infrastructural buildup, (b) future sales with a rapid buildup of fast charging stations, and (c) other incentives such as fast lanes for EVs from suburbs to the inner city, financial purchasing incentives, mandates for public transportation (including taxi services) to go electric, and support from car dealers to provide battery warranties for the lifetime of the car (so that the charging performance of a battery will not go under a certain minimum for about 12 years), along with a variety of models and price ranges offered by dealers, in addition to building a quality support network for quick service, parts, and auxiliary materials that are kept in stock. We call the first scenario "business as usual", the second scenario "logarithmic growth", and the third scenario the "Ketchup Effect". Finally, we explored some designed features in semi-constructed focused groups in a university setting to determine which internal and external features would be likely to resonate with future EV buyers in Kuwait. This is a piece of applied research that we hope will benefit the KFAS (and other stakeholders) by advising policymakers on decisions regarding Objective 13 of Kuwait's Vision 2035 on the suitability of transport within the State of Kuwait [50].

3. Literature Review

EV Policy Paper on Sustainable Transport

The majority of studies have investigated the best practices in the implementation of governmental policy on EVs in industrialized nations in the so-called Global North and, to a lesser extent, in fast-developing nations such as those in the Gulf Cooperation Council Countries (GCC) and the Middle East and North Africa (MENA). Thus, the following literature overview aims to emphasize research conducted in the GCC and the Middle East. The factors that we looked into were: (1) the cost of ownership of an EV in comparison with an ICE vehicle, which we separated into capital expenditure (CAPEX) and operational expenditure (OPEX), (2) EV infrastructure and public charging facilities, (3) public policy and incentive systems, (4) the EV driving distance on a single charge and range anxieties, (5) sustainability and environmental concerns, (6) battery life and battery performance, (7) perceived safety, trust, and reliability of EVs, (8) consumer awareness and education about EVs, and, finally, (9) EV consumer behavior. The following table lists the authors of the studies referenced in this literature review. The research is categorized as coming from the Global North (mainly Europe), the Global South, where China and India are the most prominent, and the up-and-coming Middle East, with special emphasis on research conducted in GCC nations, as depicted in Table 4.

Table 4. Literature review of EV categories across different global regions, Source: Collections of authors.

Categories of EV Features	Global North	Global South Excluding the Middle East	Middle East (GCC)
Purchasing Cost/Cost of Ownership (EV CAPEX and OPEX)	Higuera–Castillo et al. (2020) [51], Mandys (2021) [52], Müller et al. (2020) [53], Mazza et al. (2020) [54], Hardman and Tal (2021) [55]	Kongklaew et al. (2021) [56], Bhalla et al. (2020) [57]	Al-Buenain et al. (2021) [38], Shareeda et al. (2021) [58], IEA (2020) [59], Rezvani et al. (2020) [60], Chaziza (2024) [61]
EV infrastructure—charging structures	Cox et al. (2020) [62], Alvik and Bakken (2020) [18], Hardman and Tal (2021) [55], Gao et al. (2021) [63], Abdel-Basset (2024) [64]	Khazaei and Tareq (2021) [65], Kongklaew et al. (2021) [56], Dasharathraj et al. (2020) [66], Singh (2024) [67]	Shareeda et al. (2021) [58], Kiani (2021) [68], Gao et al. (2021) [63], Müller et al. (2020) [53], Bhalla et al. (2020) [57], Bilal (2024) [69], Alsabbagh (2025) [70], Gazder (2024) [71]
Public incentive and public policy	Archsmith et al. (2021) [72], Tal and Nicholas (2020) [73], Ren (2025) [74]	Kongklaew et al. (2021) [56], De Oliveira et al. (2022) [75], Gao et al. (2021) [63], Bhalla et al. (2020) [58], Qadir (2024) [76]	Kiani (2021) [68], Al-Buenain et al. (2021) [38], Tal and Nicholas (2020) [73], Dasharathraj et al. (2020) [66], Fida (2024), [77] Islam (2024) [78]
EV driving distance and range anxieties	Mandys (2021) [52], Gao et al. (2021) [63]	Khazaei and Tareq (2021) [65], Bhalla et al. (2020) [57], Feng (2025) [79]	Al-Buenain et al. (2021) [38], Shareeda et al. (2021) [59]

Table 4. Cont.

Categories of EV Features	Global North	Global South Excluding the Middle East	Middle East (GCC)
Sustainability and environmental concerns	Cox et al. (2020) [62], Egbue and Long (2021) [80], Rönkkö (2024) [81]	Kongklaew et al. (2021) [56], Zhang and Chen (2020) [82], Suman (2024) [83]	Shareeda et al. (2021) [58], Kiani (2021) [68], Sundarakani (2024) [84], Bridi (2024) [85], Ankathi [86] (2024), Ahmed (2024) [87]
Battery life/battery performance	Zhang and Chen (2020) [82] Rönkkö (2024) [81]	Khazaei and Tareq (2021) [65], Daina et al. (2020) [88], Niri (2024) [89]	Kiani (2021) [68], Haider (2022) [90]
Safety/trust/reliability	Higuera–Castillo et al. (2020) [51], Liao et al. (2020) [91]	Khazaei and Tareq (2021) [65], Tal and Nicholas (2020) [73]	Kiani (2021) [68], Hardman and Tal (2021) [55]
Consumer awareness/education	Archsmith et al. (2021) [72]	Gao et al. (2021) [63]	Haider et al. (2021) [51], Noël et al. (2021) [92]
Consumer behavior	Steinhilber (2021) [93]	Daina et al. (2020) [88], Bhalla et al. (2020) [57], Xu (2024) [94], Jiang (2024) [95]	Bhalla et al. (2020) [57], Hardman and Tal (2021) [55], Jayabalan (2024) [96] Lashram (2024) [97]

Industrialized nations, such as those in Europe, have led in research on renewable transport. China and East Asian countries are fast followers, and researchers from the Middle East are quickly catching up. It appears that, in its early stages, research focuses on asking “why?”—for example, by studying environmental benefits and sustainability—but then evolves to ask “how?”—for example, by studying incentive systems, policies, and the most suitable technologies, such as battery technology and charging infrastructure. In the GCC nations, there have been many advances in research on sustainable transport over the last 5 years. Al Buenain et al. explored the case of Qatar and found that even though Qatar produces all of its electricity by burning natural gas, a significant carbon reduction can be achieved through electromobility. The research stresses the necessity of “practical incentives and subsidies” from the government to break the path dependency on gasoline and transition to electromobility [38]. Shareeda, Al-Hashimi, and Hamdan concluded that in Bahrain, governmental financial incentives are needed in the form of tax incentives or price reductions in order for EVs to be priced equivalently to ICE cars, and that infrastructure such as a fast-charging network is paramount for rapid EVitization [58]. Kiani stressed that a public incentive system is needed in the United Arab Emirates on the level of both national and local government, in addition to an awareness campaign to educate the public about the benefits of EV transport [68].

Due to population growth in developing countries, the concept of sustainable mobility is gaining prominence among academics, leaders, managers, and governments worldwide. The usage of combustion engines in transport has increased significantly, accompanied by the growth of greenhouse gases (GHGs) emitted by traffic [86–89]. Therefore, the solution to the current environmental problem should center on sustainable mobility and greener, healthier technologies, such as electric vehicles with limited or negative greenhouse gas emissions. In order to persuade people to purchase more eco-friendly products, such as electric vehicles, it would also be crucial to shift the market through amendments, directives, and support from governments so that the adoption of greener modes of transport can promote sound environmental behavior and sustainable mobility.

4. Methodology and Data Gathering

4.1. The Methodology for Deep Interviews

This research methodology is founded on the use of qualitative approaches. For data collection, in-depth interviews with EV car dealers and EV car proprietors were conducted. A comprehensive description of the qualitative methodologies used in the data collection procedure is provided here. The current study's design and analysis were informed by the methodology proposed by the Vancouver School of Doing Phenomenology [98–104]. The study's methodology was approved by the Research Ethics Committee of the London School of Economics and Political Science on 24 November, 2021, since participants provided informed consent about the use of data and anonymity.

The seven steps of the methodology are described in Table 5 in an abbreviated fashion.

Table 5. Localized and abbreviated steps of the methodology of the authors from the Vancouver School of Doing Phenomenology.

Scope and Validation	Data from semi-structured interviews with automobile dealers were utilized to create a qualitative questionnaire with 10 open-ended questions and verified in a “dry run” with five Australian university faculty members for common terminology.
Trust Building	As taped and transcribed interviews were required, trust had to be built in the framework of Arab hospitality and mutual respect. Personal references and official introductions via company hierarchies were achieved through correspondence and phone conversations. Agreement for the interview was assumed by allowing the recording, but exact citations needed formal permission in accordance with the approval of the LSE's ethical committee or informed consent, as well as participant understanding of the procedures, processes, outputs, and outcomes of the study.
Dialogue	The interviewer visited the interviewees at their locations. The interviewer began the open-ended questionnaire with the calmest atmosphere possible, allowing interviewees time to answer each question without any haste, hints, or suggestions that might compromise data integrity.
Transcription	The interviewer's notes on body language, tone of voice, and other non-verbal indicators were recorded for each interview. The transcripts were also carefully interpreted (e.g., for attention to interview jargon and terminology).
Construction	A description that captured the results and its meaning was found.
Verification	Final verification and interpretation with certain interviews.
Externalization	Externalization to clarify the findings and promote additional study.

4.2. List of Open-Ended Questions for EV Owners in Kuwait

1. State your name, age, occupation, marital status, and number of dependents.
2. What is your EV's brand, model, specification (battery size), production year, and year of ownership? How many other cars do you own, and what are their types?
3. Why did you buy an EV? What were your motivations and expectations? Has the car disappointed you or surpassed your expectations? What was your greatest disappointment? What was your greatest pleasant surprise?
4. What is the general feeling of driving your EV?
5. What are the main difficulties that you have faced owning an EV in Kuwait?
6. What do you think is needed in terms of infrastructure to promote EVs in Kuwait?
7. What do you think is needed in terms of promotion to promote EVs in Kuwait? What features should be stressed, and who would be a likely customer?
8. What kinds of incentives, regulations, or governmental support are needed to promote EVs?
9. What is your total cost of ownership per year, considering electricity, spare parts, repair, and depreciation?
10. Given your experience with an EV, would you buy another one after this one? Why or why not?

The answers are depicted in Table 6.

Table 6. Extracted answers obtained from interviewees.

Age	Gender	Marital Status	Children	Education	Job/Title	Brand/Model	How Many Do You Own?	Positive Feedback	Negative Feedback	Comments
35	M	Married	2	BA	CTO	Tesla Model X	1	The technology behind it and it being for a better environment	No obstacles other than not having a local service center	There are several charging stations across the countries now; the only issue is we need super-charging stations between GCC countries so we can travel from one country to another using an electric car
29	M	Married	2	None	KNG	Tesla Model 3	1	Ease of use, no service required, advanced technology	No Tesla dealership in Kuwait, not enough charging stations	-
30	M	Single	0	BA	Banker	Tesla Model 3	1	I prefer decreasing the CO ₂ emissions	Not enough charging points for long journeys	At the moment, the infrastructure is not qualified for EVs
34	M	Married	2	BA	Manager	Tesla	2	I prefer its usage, technology, and money-saving	Fast-charging stations are not available. No agencies for the cars because of rules that those companies need to be owned by Kuwaities	-

Table 6. Cont.

Age	Gender	Marital Status	Children	Education	Job/Title	Brand/Model	How Many Do You Own?	Positive Feedback	Negative Feedback	Comments
35	M	Married	2	BA	Banker	Tesla Model 3	1	Performance, fast response of the car, silence, relaxed atmosphere, no service, no gas stations, safest car, no concerns on battery issues, Tesla is ahead of all other companies in design, much easier to fix body parts or tires	Cannot travel far, no penalties or tickets for those who break the law or take the parking spots of EV users	More awareness is needed, as Kuwait will not advertise since petrol is locally produced and cheap. Tesla promotes itself without spending money on ads. It is a matter of time before EVs take over; it is coming. Smart cars are the future, the wave is coming; how we catch the wave will tell the story. Small companies will perish. New legislation, the right for people to own charges, should not be rejected by house owners, just like fridges or stoves
34	M	Single	0	BA	Sales Supervisor	Polestar 2	1	High level of enjoyment, no lag or latency, google built-in, pc, one pedal drive system, safety around battery superior, lane auto-pilot, authorized agency in Kuwait	Cannot travel with the car because of range limitation	The infrastructure in Kuwait is getting prepared and will be ready. Instead of petrol, Kuwait should sell by-products

Table 6. Cont.

Age	Gender	Marital Status	Children	Education	Job/Title	Brand/Model	How Many Do You Own?	Positive Feedback	Negative Feedback	Comments
36	M	Widower	3	BA	Kuwait University	Tesla Model 3	1	Fun to drive, safe, no safety issues, software can be updated from Dubai, no need to keep it there, tires can be changed easily	Cannot travel, not enough charging points, no authorized agency	Prices of EVs started going up, meaning people started taking an interest. Incentives from the government to EV users
63	M	Married	6	None	Retired	Tesla Model 3	1	Fun to drive, safe, no safety issues, software can be updated from Dubai, no need to it there, tires can be changed easily	-	-
34	F	Married	1	MA	Public	Mercedes EQC	1	No need for regular maintenance, oil change, etc.	Lack of experience in maintenance, speed bumps	-
35	M	Married	3	BA	Private	Tesla Model 3	2	Saving time and resources	Lack of having local dealers	-

5. Discussion of the Findings

5.1. Summary of EV Owners' Feedback and Insights

An in-depth thematic analysis was conducted through interviews with 10 electric vehicle (EV) owners, consisting of eight Tesla owners, one Polestar owner, and one Mercedes owner. The key findings from this analysis are as follows.

The age distribution of the EV owners interviewed ranged from 29 to 63 years old, with the majority falling in their late 20s to mid-30s, specifically at ages 29, 30, 34, 34, 35, 35, 35, 36, and 63. Regarding gender, most of the participants were male, indicating a potential gap in marketing efforts towards women and suggesting a need for more targeted campaigns aimed at female audiences. In terms of marital status, seven of the owners were married, two were single, and one was a widower. Most of the owners (eight) had only one vehicle, while two individuals owned two cars.

5.2. Key Reasons for Preferring EVs

Electric vehicle (EV) owners in Kuwait shared several compelling reasons for choosing this technology. A major motivation is the environmental benefit, as EVs are considered a cleaner option than traditional vehicles as they help reduce emissions and support a more sustainable future for the region. Additionally, EVs are valued for their advanced technology, offering features such as cutting-edge software, user-friendly interfaces, and innovative energy management systems. Owners also appreciate the low maintenance requirements of EVs, as they have fewer moving parts, resulting in lower upkeep costs.

Economic efficiency is another key factor, with EVs offering reduced fuel expenses and the potential for government incentives in Kuwait. The superior performance of EVs, such as instant torque and smooth acceleration, in addition to their quiet operation, contributes to a more enjoyable driving experience. Improved safety features, including advanced structural designs and low centers of gravity, also make EVs more attractive.

Driving enjoyment is another reason many Kuwaitis choose EVs, with drivers highlighting the smooth, powerful ride that they provide. The availability of authorized dealerships ensures easy vehicle maintenance, while convenient software updates allow owners to improve performance without frequent trips to service centers. Finally, the ease of tire changes adds to the appeal, offering owners peace of mind considering that regular vehicle upkeep is simple and accessible in Kuwait. Therefore, these factors make EVs a popular choice for drivers in Kuwait seeking modern, efficient, and high-performance vehicles.

5.3. Challenges Faced by EV Owners

Despite the many benefits of owning an electric vehicle (EV), owners in Kuwait face several challenges that affect their overall satisfaction. One significant issue is that speed bumps, especially in areas with lower ground clearance, can make driving uncomfortable, particularly for EVs. Another challenge is the lack of local charging station centers and services, which means that owners must often travel long distances or experience delays when seeking fast-charging stations or even for maintenance or repairs. In addition, the limited number of authorized dealerships in the state of Kuwait further exacerbates this problem, restricting access to spare parts and professional support.

One of the main key concerns is the insufficient number of charging stations, which creates inconvenience for everyday use and increases range anxiety among owners, especially for those who live far from their work and need to drive long distances inside Kuwait. Finally, many EV owners express frustration with the difficulty of using their vehicles for long-distance travel. The lack of adequate charging infrastructure and the long charging times make EVs less practical for road trips across the region. These challenges highlight

the need for further improvements in EV infrastructure and services in Kuwait to improve the ownership experience.

5.4. Top Concerns and Highlights from EV Owners' Feedback

Electric vehicle (EV) owners in Kuwait shared positive feedback about several key features that make EVs an appealing choice. One of the main attractions is the advanced technology, which includes cutting-edge software, user-friendly interfaces, and innovative energy management systems, offering a sophisticated and modern driving experience. Another major advantage is that EVs are environmentally friendly and operate quietly, reducing emissions and contributing to a cleaner, quieter environment, especially in busy urban areas such as Kuwait.

In terms of cost, many owners highlight the economic benefits of EVs, noting the long-term savings on fuel and maintenance. However, despite these advantages, EV owners in Kuwait face significant challenges. A major concern is the limited availability of service centers and authorized dealers, which makes it difficult for owners to obtain timely repairs and support. The lack of charging stations is another issue, severely limiting the ability to use EVs for long-distance travel. The shortage of charging infrastructure restricts the practical use of EVs for road trips, which is a critical barrier to wider adoption.

While the benefits of owning an EV in Kuwait are clear, improving infrastructure is essential to address these challenges and ensure a more seamless ownership experience.

5.5. Recommendation from EV Owners

To improve EV adoption and the ownership experience, Kuwait's EV owners offered several recommendations. First, they suggest increasing public awareness of the advantages of EVs. Many believe that better education on the environmental, economic, and technological benefits of EVs could encourage more people to switch from traditional vehicles to electric ones. Emphasizing benefits such as lower emissions, cost savings, and advanced features could help build public interest and confidence in EVs.

Another key recommendation is to accelerate the development of EV infrastructure, particularly by adding more charging stations and establishing additional service centers. Expanding the network of fast-charging stations across Kuwait would help reduce range anxiety and make EVs more practical for both daily use and long-distance travel. Increasing the number of local service centers and authorized dealerships would also improve the accessibility of maintenance and repairs. Implementing these recommendations would greatly enhance the EV ownership experience in Kuwait and help promote the wider adoption of electric vehicles.

6. Conclusions

Kuwait's shift toward electric vehicles presents both challenges and opportunities. As of the end of 2024, only 781 EVs were registered, representing just 0.03% of the country's total vehicle population of 2.5 million. This low adoption rate highlights the gap that Kuwait must address to meet its sustainability goals. However, with advancements in technology, supportive government action, and shifting consumer preferences, Kuwait is well positioned to accelerate EV adoption in the next decade.

A key barrier to EV adoption in Kuwait is the lack of fast-charging infrastructure. With only 43 slow-charging stations (AC-DC) and two fast-charging stations (DC-DC) as of 2024, the current network is insufficient. For an effective network, there needs to be at least one charging station per gasoline station, of which there are about 150 in Kuwait [105]. In addition to infrastructure, government incentives will be vital in making EVs more affordable for consumers, especially for cheaper cars to reach mainstream customers. The

price difference of more than 10% between similar ICE models acts as a barrier. Subsidies for EVs, tax breaks, and carbon credits are a must to equalize the price difference in more mainstream vehicles, which might need larger batteries than in other countries because of the greater use of air conditioning than in countries where the temperature is closer to 20 °C [106]. Push strategies, such as strong leadership at the highest level, are needed, along with education programs about the benefits and safety of EVs, as with the program that was implemented in Qatar. Moreover, non-financial incentives, such as reduced registration fees, free parking, and waived tolls, could make EV ownership more appealing, especially in urban areas. Another critical factor that will influence the pace of adoption is technological innovation, particularly in battery technology. The Kuwait Institute for Scientific Research (KISR) and the Ministry of Electricity, Water, and Renewable Energy are playing a pivotal role in advancing battery research and optimizing charging infrastructure in collaboration with global partners. The development of solid-state batteries, which offer greater thermal stability and efficiency, could address concerns about the performance of EVs in Kuwait's extreme climate. Coupling this with solar-powered charging stations, Kuwait could leverage its abundant sunshine to create a more sustainable and cost-efficient charging network. This would not only reduce the reliance on fossil fuels but also position Kuwait as a leader in sustainable energy solutions within the region. The government could also support corporate fleet electrification by offering tax breaks or financial incentives for companies investing in EVs or charging infrastructure. Public-private partnerships would be essential in expanding the nation's charging network, addressing range anxiety, and making EV ownership more practical. Introducing emission regulations and setting targets for zero-emission vehicles would further push automakers and consumers toward EVs, creating a regulatory framework that aligns with global efforts to reduce carbon emissions. In conclusion, while the adoption of EVs in Kuwait has been slow, the country has the potential to accelerate its transition to electric mobility over the coming years. The expansion of charging infrastructure, government incentives, and technological advancements will be key drivers in this shift. With the continued efforts of organizations such as the KISR and government ministries, Kuwait is well positioned to overcome current barriers and achieve a more sustainable, environmentally friendly transportation system by 2030. For Kuwait to realize its full potential in the EV market, it must adopt a multi-faceted approach that combines infrastructure development, policy support, and consumer education to ensure a greener and more efficient future. Integrating renewable energy into the EV infrastructure would also place Kuwait in a leadership position within the Gulf region, alongside countries such as the UAE and Saudi Arabia, which are already making significant investments in renewable energy and EV infrastructure. Kuwait's ample sunshine provides a unique opportunity to harness solar energy to accelerate EV adoption while also meeting its carbon reduction goals and enhancing its global reputation as an environmentally conscious nation [89,106–108].

Author Contributions: A.O. was this study's project leader and was responsible for its conception, methodology, formal analysis, data collection, and administration, as well as the collection of funds. M.N. was responsible for providing data from databanks and industrial data collection. H.H. and A.A.K. were responsible for editing, formatting, the literature review, conceptualization, synthesis, methodology, validation, data curation, and writing and preparation of the original document. All authors have read and agreed to the published version of the manuscript.

Funding: This article is a part of a wider study called "Breaking the ICE's reign: A mixed-method study of attitudes towards buying and using EVs in Kuwait". This study was funded by the Kuwait Foundation for the Advancement of Sciences and is administrated by the London School of Economics and Political Science—Middle East Centre (grant number: KFAS-MEC LSE 2021 001).

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the London School of Economics and Political Science Ethics Committee (Approval Code 0055800004KJE9AAO), with the approval granted on 24 November, 2021.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The original contributions presented in the study are included in the article, further inquiries can be directed to the corresponding author.

Acknowledgments: We acknowledge the use of AI tools for proofreading, grammar refinement, and stylistic editing of key sections to enhance their clarity and coherence. Additionally, several tables/figures were enhanced using AI-based graphic design software to achieve a more professional, visually appealing presentation, ensuring that complex data are presented in a comprehensible format.

Conflicts of Interest: Mohammed Navfal is an employee of Kia Motors. The paper reflects the views of the scientists, and not the company.

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