QATAR NATIONAL DIALOGUE ON CLIMATE CHANGE
حـــوار قطـــر الوطني حـــول تـــغـيـر الـــمـنـاخ
15-16 OCTOBER 2023 15-16 أكتـــوبر 2023

QNDCC 2023 White Paper

Sustainable Transportation

November 19, 2023

وزارة البيئـــة والتغيّـــر المناخـــي
Ministry of Environment and Climate Change
State of Qatar • دولـــة قطـــر

إرثنا earthna
عـضـو فـي مـؤسـسـة قـطـر
Member of Qatar Foundation

White Paper
QNDCC
15-16 October 2023

Sustainable Transportation

November 19, 2023
Prepared by Strategy Hub

About Earthna

Earthna Center for a Sustainable Future (Earthna) is a non-profit policy, research, and advocacy organization, established by Qatar Foundation to promote and enable a coordinated approach to environmental, social, and economic sustainability and prosperity.

Earthna is a facilitator of sustainability efforts and action in Qatar and other hot and arid countries, focusing on sustainability frameworks, circular economies, energy transition, climate change, biodiversity and ecosystems, cities and the built environment, and education, ethics, and faith. By bringing together technical experts, academia, government and non-government organizations, businesses and civil society, Earthna fosters collaboration, innovation, and positive change.

Using their home - Education City - as a testbed, Earthna develops and trials sustainable solutions and evidence-based policies for Qatar and hot and arid regions. The organization is committed to combining modern thinking with traditional knowledge, contributing to the well-being of society by creating a legacy of sustainability within a thriving natural environment.

For more information about Earthna and to stay updated on our latest initiatives, please visit www.earthna.qa

Report Team

Dr. Soud K. Al-Thani
Director, Earthna, Qatar Foundation,
Doha, Qatar

Sheikha Amna Al Thani
CEO, Strategy Hub,
Doha, Qatar

Francis Antony Jacob
Earthna, Qatar Foundation,
Doha, Qatar

Mohamed A. Mohamed
Earthna, Qatar Foundation,
Doha, Qatar

Haajerah Khan
Strategy Hub,
Doha, Qatar

Leen Al-Rabbat
Strategy Hub,
Doha, Qatar

Shikha Maunik Patel
Intern, Qatar University
Doha, Qatar

Editorial board

P.O. Box: 5825, Doha, Qatar
Telephone: (+974) 4454 0242; internet: www.earthna.qa

PI: ETCC-2024-004

Table of Contents

Executive Summary

Exploring the imperative issue of Sustainable Transportation, this analysis focuses on key areas discussed during the third annual Qatar National Dialogue for Climate Change (QNDCC) panel session titled "Sustainable Transportation - Public Transport Infrastructure, Alternative Fuels, EVs & Logistics." The comprehensive scope of the study includes detailed insights, supplementary research, and targeted recommendations aimed at fortifying Qatar's commitment to actualizing its national sustainability objectives, particularly In the realm of sustainable transportation.

The findings underscore the urgent need for a paradigm shift in global transportation systems that significantly contribute to climate change through carbon emissions and fuel consumption. The paper discusses the most prominent international agreements adopted as well as the current popular solutions trending worldwide in the transition to sustainable transportation. Advocating for sustainable transportation modes, the discourse highlights low, zero-emission, and energy-efficient modes as critical components of mitigating climate change.

The paper highlights numerous challenges countries all over the world face, including Qatar. Such challenges include high initial cost, lack of clear policies, economic constraints, public resistance, extreme climate conditions, and specific issues in sustainable aviation and maritime transport.
The paper then lists a set of recommendations to overcome the detailed challenges and implement sustainability solutions. These recommendations include the integration of cutting-edge technology for traffic management, the development of a clear policy framework to guide stakeholders, robust intersectoral cooperation to balance short-term economic gains with long-term sustainability goals, the development of incentivization programs, investments in research, economic diversification, and the creation of pedestrian-friendly areas. Embracing these recommendations will not only contribute to achieving global climate goals but will also position Qatar at the forefront of sustainable development, aligning with the Qatar National Vision 2030 (QNV 2030).

Scope and Methodology

The scope of the analysis covers the topics discussed in the Panel Session "Sustainable Transportation - Public Transport Infrastructure, Alternative fuels, EVs & Logistics" on the second day of the QNDCC, in addition to supplementary research to substantiate the session's key findings and produce optimally relevant recommendations. The discussed findings can be utilized to enhance Qatar's national sustainability goals and develop relevant local and regional sustainability initiatives. The methodology followed for data collection includes preliminary academic research, on-site session note-taking, and post-session supplementary research and benchmarking. Based on the detailed insights, this research paper provides a set of general and Qatar-specific recommendations to support the implementation of sustainable solutions for the transportation sector.

The Transportation Sector and Climate Change

The 21st century has witnessed an unparalleled upsurge in the rate of urbanization and economic development around the world, especially in developing countries such as Qatar. Currently, half of the world's population resides in urban areas, a ratio that is projected to increase to two-thirds by 2050.[1] These urban areas serve as the economic centers of countries, attracting residents and commuters from different distances. As a result, urban areas often face increased traffic congestion due to daily work commutes of employees in personalized vehicles, exacerbating the impact of these vehicles on the environment. In addition to on-land transportation, the increased economic and political cooperation between states has led to unprecedented growth in air and marine traffic, increasingly compounding the negative effects of these modes of transportation on the environment and on climate change.[2]

The existing modes of transportation – mainly road, rail, aviation, marine, ferry, and urban public transport providers – considerably contribute to the worsening of the global environment, as they account for about 64% of global oil consumption, 27% of all energy consumption, and 23% of energy-related carbon dioxide emissions.[3] The status quo of the global transportation system can be improved in terms of sustainability criteria due to its reliance on conventional fuel sources and internal combustion engines which emits various gasses and substances such as CO_2, CO, oxides of nitrogen and sulfur, volatile organic compounds (toxic air pollutants like benzene, formaldehyde, cyanide dioxide, etc.), and fine particulate matters such as black carbon, heavy metals, and micro and nano plastics.[4]

Accordingly, states have begun adopting sustainability strategies that can enhance their national transportation and help mitigate the detrimental environmental impacts of conventional transport modes. The term sustainable transportation often refers to "low and zero-emission, energy-efficient, and affordable modes of transport." These modes of transport include electric, hybrid, alternative-fuel, and fuel-efficient vehicles that emit fewer greenhouse gasses and are ultimately cost-effective.[5] Electric vehicles (EV), are cars that run on rechargeable batteries instead of fuel combustion engines. There are two main types of EVs, fully electric vehicles and hybrid vehicles. The hybrid vehicle has both a battery and a combustion engine; it consumes the available electricity before running on the available gasoline,[6] effectively decreasing the quantity of needed gasoline. Alternative-fuel vehicles and marine and aircrafts, on the other hand, diversify reliance on additional fuels such as biodiesel, electricity, ethanol, hydrogen, natural gas, and propane to conserve fossil fuel resources and reduce emissions.[7]

Additionally, modern manufacturers are constantly exploring different ways to optimize these transportation methods so that to require less fuel and emit fewer emissions. For example, numerous studies analyze the effects of decreasing the weight of an aircraft by using different types of building materials so that the plane requires less energy to take off and sustain itself in the air. Such displays of research-based innovation are necessary for countries and businesses to take concrete steps toward actualizing real mitigation of climate change that can help them meet their sustainability goals and transform the transportation sector sustainably.[8]

[1] United Nations, "World Urbanization Prospects 2018," 2022. https://population.un.org/wup/DataQuery/

[2] Leila Mead, "The Road to Sustainable Transport," IISD, May 2021. https://www.iisd.org/articles/deep-dive/road-sustainable-transport

[3] Ibid.

[4] Kinjal J. Shah et al., "Green Transportation for Sustainability: Review of Current Barriers, Strategies, and Innovative Technologies," Journal of Cleaner Production, volume 326, 2021. https://doi.org/10.1016/j.jclepro.2021.129392.

[5] United States Office of Energy Efficiency and Renewable Energy, "Sustainable Transportation and Fuels," https://www.energy.gov/eere/sustainable-transportation-and-fuels#:~:text=Sustainable%20transportation%20refers%20to%20low,savings%20on%20fuel%20and%20vehicles

[6] United States Environmental Protection Agency, "Electric & Plug-In Hybrid Electric Vehicles," https://www.epa.gov/greenvehicles/electric-plug-hybrid-electric-vehicles

[7] United States Office of Energy Efficiency and Renewable Energy, "Sustainable Transportation and Fuels," https://www.energy.gov/eere/sustainable-transportation-and-fuels#:~:text=Sustainable%20transportation%20refers%20to%20low,savings%20on%20fuel%20and%20vehicles

[8] Patrycja Blechinger, "How to reduce the weight of an airplane and CO2 emissions at the same time?" Industry Insider- Aerospace Industry, January 2022. https://industryinsider.eu/aerospace-industry/reduction-of-the-weight-of-the-aircraft/

As the world population, urbanization, and economic activity continue to grow, 2.5 billion more people are expected to move to urban areas by 2050. Coupled with the widespread consumption culture and the younger generation's high demand for personalized vehicles, this expectation indicates that the transportation system will double in magnitude between 2005 and 2050, with vehicle numbers increasing by three to four times. These alarming forecasts demonstrate the immediate need to sustainably transform the present transportation systems to meet the needs of individuals worldwide who commute for work, school, commerce, and other reasons.[9] Although economic advancement remains a national priority, especially for developing countries, climate change presents formidable challenges that necessitate social cooperation, enterprise compliance, and environmental protection for long-term sustainable development.[10]

[9] Leila Mead, "The Road to Sustainable Transport," IISD, May 2021. https://www.iisd.org/articles/deep-dive/road-sustainable-transport

[10] United Nations, "World Urbanization Prospects 2018," 2022. https://population.un.org/wup/DataQuery/

Transport-Related International Agreements

As a part of the global cooperation to mitigate the impacts of climate change and encourage sustainable development, there have been numerous international agreements and declarations that support united efforts toward achieving these mutual goals. Most notably, the Paris Agreement is a legally binding international treaty on climate change, adopted by 196 parties in 2015 under the United Nations Framework Convention on Climate Change (UNFCC). Requiring national economic and social transformation, the Agreement aims to limit "the increase in the global average temperature to well below 2°C above pre-industrial levels,"[11] as well as "limit the temperature increase to 1.5°C above pre-industrial levels." Every country must submit its nationally determined contributions (NDCs) to communicate its respective actions and plans to reduce greenhouse gas emissions in order to reach the goals of the Paris Agreement. The Agreement notably highlights the importance of sustainable transportation in reducing greenhouse gases, as adopting measures for sustainable transportation is mandatory for countries committed to submitting their NDCs.[12]

Launched in 2018 after the One Planet Summit was held in Paris, the Transport Decarbonisation Alliance (TDA) is a coalition of countries, cities, regions, and major players in sustainable, low-carbon mobility. The TDA aims to achieve the following goals through joint collaborations: elevating world ambition for the transport sector through a common vision, enabling tangible actions by designating its members as "Communities of Interest," and influencing international policy in key areas related to climate change and sustainable development. New Communities of Interest can be formed for certain durations with the goal of performing activities that provide specific outputs related to the focus area.[13]

The COP26 Declaration is another global agreement that aims to bring about sustainable transitions, particularly in transportation. Launched by the UK COP presidency in 2021, the Declaration seeks to accelerate the transition to 100% zero-emission cars and vans by 2040 globally. The Declaration was signed by national governments, states, regions, cities, vehicle manufacturers, businesses, investors, and civil society. The signatories of the Declaration vow to cooperate through "greater levels of investment into research, manufacturing, supply chains, infrastructure, and development assistance" so that the transition to zero-emissions is faster and easier for all parties, and at a lower cost.[14] Such international agreements demonstrate the fruits of joint international cooperation toward achieving common goals, and they provide the basis for rolling out future action plans and implementing transport-related sustainable solutions.

[11] United Nations Framework Convention on Climate Change Secretariat, "The Paris Agreement," https://unfccc.int/process-and-meetings/the-paris-agreement

[12] OECD, "Transport CO2 and the Paris Climate Agreement Reviewing the Impact of Nationally Determined Contributions," [Statutory Report], 2018. https://www.itf-oecd.org/sites/default/files/docs/transport-co2-paris-climate-agreement-ndcs.pdf

[13] Transport Decarbonisation Alliance, "About Us," https://tda-mobility.org/background/

[14] The Climate Group, "Our Declaration," https://cop26transportdeclaration.org/en/?contextKey=en

Current Trends To Mitigate Transport-Related Impacts

Table 1 Information noted from the "Survey of Global Activity to Phase Out Internal Combustion Engine Vehicles." [16]

Table 1: Global Pledges and Phase Out of ICE Targets

Country	"Phase Out of ICE" Official Targets	Action Date
Britain	No new ICE vehicles sold after 2035	2020
Costa Rica	70% of buses and 25% of cars electric by 2035	2019
Egypt	No new ICE vehicles sold after 2040	2018
Germany	No registration of ICE vehicles by 2030; Cities can ban diesel cars	2016
Ireland	No new ICE vehicles sold after 2030; Introduced incentive program for EV sales	2017
Netherlands	No new ICE vehicles sold after 2030, phase-out begins 2025	2017
Sri Lanka	Replace all state-owned vehicles with electric or hybrid models by 2025, a move that will be extended to private vehicles by 2040	2017
Taiwan	Phase out fossil fuel-powered motorcycles by 2035 and fossil fuel-powered vehicles by 2040; The replacement of all government vehicles and public buses with electric versions by 2030	2017

Recognizing the urgency to act quickly, many countries have taken steps to make their transportation systems more sustainable through target pledges, strategy development, and national plan adoption. As such, many have adopted "Phase-Out of Internal Combustion Engines Vehicles" (ICE) national plans, stating they will phase out passenger ICE vehicles that are powered by fuels such as petrol, liquefied petroleum gas, and diesel in the span of the coming decades. Instead, these countries aim to incentivize EV adoption and public transportation utilization at the national level. Table 1 Global Pledges and Phase Out of ICE Targets displays different examples of pledges and "Phase-Out of ICE" targets that some countries have notably made.[15]

As Table 1 demonstrates, the countries listed have announced targets and pledges to halt the sale, import, or registration of ICE vehicles, implement EV incentivization programs, and increase the percentage of EVs in their transportation systems. Countries have yet to introduce binding legislation to implement the ban of sold ICE vehicles. In the near future, such legislation may start to be drafted and implemented as countries work towards fulfilling their targets.[17]

In addition to the national plans, some cities have introduced low-emission zones (LEZs) or zero-emission zones (ZEZs) to limit the use of ICE cars in some of their territories. Globally, such zones are growing in number, area span, and strictness.[18] Cities can introduce these rules

[15] Isabella Burch and Jock Gilchrist, "Survey of Global Activity to Phase Out Internal Combustion Engine Vehicles," The Climate Center, Last modified March 2020. https://theclimatecenter.org/wp-content/uploads/2020/03/Survey-on-Global-Activities-to-Phase-Out-ICE-Vehicles-update-3.18.20-1.pdf

[16] Ibid

[17] Ibid.

[18] Frank Jacobs, "EV incentives and city bans in Europe: an overview," Fleet Europe, September 2020. https://www.fleeteurope.com/en/new-energies/europe/features/ev-incentives-and-city-bans-europe-overview?a=FJA05&t%5B0%5D=Electrification&curl=1

because they have jurisdiction over land use, zoning, and local law enforcement. In Paris and Barcelona, for example, drivers must register their vehicles to receive a special sticker that indicates if the car is zero-emission compliant. If the car does not meet the necessary requirements, it is not allowed into designated areas of the city during the weekdays. In London and Oxford, vehicles that are not identified as zero-emission are charged for driving within certain city parameters. As some cities have seen more success with this methodology to decrease ICE vehicle utilization, other cities are being inspired to implement their own policies to support zero-emission transportation.[19]

France is a prominent global example of a proactive political actor in overall sustainability, and transport sustainability in particular. On August 17, 2015, France legally implemented "the National Low-Carbon Strategy (SNBC)," effectively serving as France's policymaking roadmap for climate change mitigation, along with the "National Adaptation to Climate Change Plan." The SNBC was then later updated in 2017 at the first "One Planet Summit." Outlining guidelines for implementable actions to transition to a low-carbon, circular, and sustainable economy in all sectors, the SNBCS particularly focuses on the transportation sector since it is currently the largest greenhouse gas emitting sector in France- accounting for 30% of national emissions in 2015. The targets of the transport-related guidelines include:[20]

- Achieving 100% zero-emission light vehicle sales by 2040.
- Attaining 100% carbon-free domestic maritime transport by 2050 and promoting low-carbon technologies in French ports.
- Replacing a significant portion of aircraft fuels with biofuels (50% by 2050) and developing hydrogen or electric-powered aircraft.
- Promoting a modal shift toward energy-efficient and low-emission transport modes like rail, public transport, and cycling (aiming for 12% cycling modal share by 2030 and 15% by 2050).
- Assisting local authorities and businesses in implementing clean mobility initiatives, such as low-emission zones and fleet renewal plans.

Regionally, although oil and gas constitute a major source of national revenue and domestic fuel for several Middle Eastern countries, numerous governments in the Gulf Cooperation Council (GCC) are focusing on adopting renewable energy and clean transportation strategies in tangent with economic and energy diversification plans. Saudi Arabia, for example, aims to have 30% of vehicles in Riyadh electric by 2030.[21] In a big step towards this, Saudi launched its first EV company "Ceer." The company is a joint venture between the Public Investment Fund and the Taiwanese electronics company Foxconn. Scheduled to be available in 2025, Ceer represents the latest attempt by Saudi Arabia to transition to more sustainable and environmentally friendly industries.[22]

Qatar's transportation sector witnessed notable advancement in relation to EV adoption and public transport optimization. In June 2023, Qatar announced the launch of its first EV brand "VIM" with an exclusive Qatari intellectual property, granting the car manufacturer the sole authority to use, make, sell, or license certain aspects of the car's design, technology, or features. The launch of this EV is a notable step amidst Qatar's larger sustainable transportation initiative. The "Public Bus Infrastructure Program," for example, facilitates the operation of eco-friendly electric buses, successfully achieving 25% electrification of its public transit bus fleet in 2022, and aiming for 100% electrification by 2030. The Program lays the foundation for a full transition to an electricity-powered transit system that is clean and eco-friendly by using the latest technologies. Thousands of these electric buses are being manufactured at Qatar Free Zones (QFZ), as part of an agreement between QFZ, Yutong (China), and Mowasalat. This multilateral framework has many added benefits: the e-bus factory will serve the local market, support the development of an electric vehicle industry through the availability of auto parts manufacturing, attract companies in the electric vehicle battery sector, and include the set-up of a service center in QFZ to provide supporting services including battery maintenance, repairs and replacement, training, and research and development. This step aims to support in the national adoption of EVs by Qatari citizens and residents.

In the QNDCC panel session discussion, Mohamed Abu Khadija - Director of Strategy at Mowasalat (Karwa) - discussed how it focuses its sustainability efforts around three key pillars: electrification of vehicles, digitization of processes, and improved accessibility for all customers. Qatar has invested heavily in researching EV adoption, with a focus on last-mile connectivity and charging infrastructure, a contribution that significantly reduced CO_2 emissions during the FIFA World Cup Qatar 2022™. For the span of the event time, the electric buses drove more than 1.8 million km across Qatar, which is equivalent to planting 12,000 trees worth of CO_2.

Numerous countries are exploring ways to increase railway transportation due to its minimal CO_2 emissions, higher energy efficiency, and city decongestion benefits. As a leading company in the rail transport market, the current priority of Alstom is electrifying railway lines and enhancing battery efficiency, targeting 100% sustainability in their tram manufacturing by 2050, as mentioned by Paul Bou Chebl - Vice President of Strategy at Alstom Africa, Middle East & Central Asia (AMECA) - in the QNDCC panel session. An example of international railway prioritization is France's recent upgrade of its railway system as a part of its "Recovery and Resilience Plan." While France already owns one of Europe's most extensive and efficient high-speed rail networks, in September 2020, France allocated approximately 4.7 billion euros "to regenerate, modernize and secure the railway infrastructure, develop night trains, rehabilitate low-density lines with regions to maintain public services, and sustain investment in "capillary" lines (necessary to access factories and production sites)"[26] in order to reduce its ecological and carbon footprint. These operational and strategic improvements target both passenger and goods transport, and they include logistical cooperation between different national entities to guarantee optimal planning and performance.[27]

Qatar has also prioritized developing its electric rail project, "The Doha Metro", as a key pillar to the national comprehensive and sustainable public transportation system. The Metro has revolutionized the way residents move around Doha and its suburbs, as it serves most of the capital's locations timely and efficiently.[28] These initiatives demonstrate different means that countries all over the world have pursued to make their transportation systems more sustainable, and there are notably more options states can explore to expedite this transformation process in order to meet their sustainability goals.

[19] Isabella Burch and Jock Gilchrist, "Survey of Global Activity to Phase Out Internal Combustion Engine Vehicles," The Climate Center, Last modified March 2020. https://theclimatecenter.org/wp-content/uploads/2020/03/Survey-on-Global-Activities-to-Phase-Out-ICE-Vehicles-update-3.18.20-1.pdf

[20] The French Ministry of Ecological Transition and Territorial Cohesion, "National Low Carbon Strategy," March 2020. https://www.ecologie.gouv.fr/sites/default/files/en_SNBC-2_summary.pdf

[21] Jennifer Gnana, "Saudi Arabia wants 30% of vehicles on Riyadh's roads to be electric by 2030," The National News, October 2021. https://rb.gy/9azhna

[22] Ceer, "About Us," https://ceermotors.com/about-us/

[23] Asmahan Qarjouli, "Qatar launches its first electric vehicle company with intellectual property," Doha News, June 2023. https://dohanews.co/qatar-launches-first-electric-vehicle-company-with-intellectual-property/

[24] Irfan Bukhari, "Public Bus Infrastructure Programme provides integrated transit system," The Peninsula, April 2023. https://thepeninsulaqatar.com/article/01/04/2023/public-bus-infrastructure-programme-provides-integrated-transit-system

[25] QFZ, "Advanced Mobility," 2021. https://qfz.gov.qa/wp-content/uploads/2021/08/QFZA-Advanced-Mobility-Booklet_v6-1.pdf

[26] Garnik Gondjian and Cédric Merle, "France's €100bn Recovery Plan: the government strikes a balance between socio-economic emergency and ecological transition," Natixis, September 24, 2020. https://gsh.cib.natixis.com/our-center-of-expertise/articles/france-s-100bn-recovery-plan-the-government-strikes-a-balance-between-socio-economic-emergency-and-ecological-transition

[27] Ibid.

[28] Qatar Rail. "About Metro & Tram." https://www.qr.com.qa/metro-tram?code=AboutMetroAndTram

Current Trends To Mitigate
Transport-Related Impacts

Challenges To Solution Implementation

There are numerous challenges countries face when implementing solutions for sustainable transportation, and the obstacles vary depending on the social, political, and economic context of each country. Some of the most common challenges globally include:

High initial investment cost and the lack of infrastructure: Establishing a sustainable transportation infrastructure requires a considerable initial government investment to build public transit systems, install EV charging stations, and develop EV or bike lanes. An initial investment of time and resources also needs to go toward researching practical and ideal logistics of sustainable solution implementation for traffic management, urban planning, and other logistical issues. This can be a time-consuming and expensive process that countries with limited funding and competing priorities could struggle with.[29]

Absence of clear policies: As mentioned earlier, most countries do not have clear legislation or policies that define boundaries for transportation and direct businesses and the public toward adopting specific modes of transportation. This is because transportation policies often involve complex political and economic considerations, and balancing the interests of various stakeholders, including businesses, consumers, and government entities, can be challenging and time-consuming. Additionally, drafting and implementing legislation is a lengthy process, and as the sector is undergoing rapid technological advancements, legislation often struggles to keep pace. The lack of a regulatory framework and policy program that both incentivizes and deters specific actions impedes the full implementation of sustainable transportation solutions and their adoption by enterprises and the public.[30]

Economic constraints and supply chain concerns: Depending on their stage of development and economic context, some countries prioritize short-term economic benefits over long-term sustainability goals. As such, it would make it difficult to implement expensive but environmentally friendly transportation solutions. Countries also consider the risk of facing potential supply chain disruptions or shortages of sustainable transportation technologies that may affect the nationwide adoption of these solutions and negatively impact the government's investment.[31]

Public awareness and resistance to change: Many countries may face social resistance to changing personal transportation modes and adopt more sustainable ones. This unwillingness to change could stem from a lack of awareness about the importance and advantages of sustainable transformation, a belittling of the significance of one's individual actions, or the impracticality of changing one's usual mode of transportation. For example, in regions where car ownership is considered a status symbol, convincing people to use public transit or bicycles can be challenging. [32]

The State of Qatar faces some of these challenges in implementing sustainable transportation solutions that are influenced by its climate, geography, and economic conditions. While Qatar has invested greatly in researching EV feasibility, optimizing road logistics, and establishing needed infrastructure such as charging stations and an electric metro station, Qatar still lacks clear policy frameworks that incentivize the public to transition to more sustainable modes of transportation. Additionally, the risk of facing supply chain shocks for eco-transit technology such as vehicle batteries or spare parts is still a considerable concern for the state. Moreover, the majority of people in Qatar still opt for using their personalized ICE vehicles instead of public transportation or EVs. The following lists additional Qatar-specific challenges that may limit the implementation of sustainable transportation solutions.

Limited EV options: There are currently very limited EV options in Qatar that individuals can buy, and the options that are available tend to be relatively expensive for customers. Not having enough options that are affordable deters the public from purchasing a vehicle brand that they feel they can afford or trust.[33]

Extreme climate conditions: The hot and arid climate in Qatar poses challenges for EVs and their batteries since extreme temperatures can impact battery performance

and lifespan. Dust and sand can also affect the maintenance and efficiency of Qatar's transportation infrastructure. This challenge may prevent individuals from opting to buy EVs if they feel like they will quickly malfunction. The extreme weather can also deter individuals from relying on bikes or other pedestrian-friendly modes of transportation.[34]

Challenges for sustainable aviation and maritime transport: Since Qatar Airways and Qatar's marine ports are integral parts of Qatar's economy and transportation system, there are specific challenges that can impact the implementation of sustainable practices. One challenge is developing infrastructure for sustainable aviation, such as facilities for electric or hybrid planes and sustainable aviation fuel production. Additionally, integrating such infrastructure and green technologies requires significant investment and research. Moreover, sourcing and utilizing sustainable fuels for maritime transport can be challenging due to the limited availability and scalability of alternatives to traditional marine fuels.

Addressing these challenges, both globally and in Qatar, requires coordinated effort from governments, businesses, and communities to develop comprehensive strategies, policies, and incentives that promote sustainable transportation practices. Furthermore, specific considerations for the local environmental conditions, cultural factors, and economic state should be accounted for when exploring different methods to implement sustainable transportation solutions in Qatar.

[29] American Journal of Transportation, "Top challenges of sustainable logistics and how to overcome them," June 2023. https://www.ajot.com/news/top-challenges-of-sustainable-logistics-and-how-to-overcome-them

[30] Isabella Burch and Jock Gilchrist, "Survey of Global Activity to Phase Out Internal Combustion Engine Vehicles," The Climate Center, Last modified March 2020. https://theclimatecenter.org/wp-content/uploads/2020/03/Survey-on-Global-Activities-to-Phase-Out-ICE-Vehicles-update-3.18.20-1.pdf

[31] Sonja Forward, "Challenges and barriers for a sustainable transport system – exploring the potential to enact change," TRANSFORUM, May 2014. https://www.diva-portal.org/smash/get/diva2:1051470/FULLTEXT01.pdf

[32] Ibid.

[33] Fayez Alanazi, "Electric Vehicles: Benefits, Challenges, and Potential Solutions for Widespread Adaptation," Applied Sciences 13, no. 10: 6016, 2023. https://doi.org/10.3390/app13106016 [33] Fayez Alanazi, "Electric Vehicles: Benefits, Challenges, and Potential Solutions for Widespread Adaptation," Applied Sciences 13, no. 10: 6016, 2023. https://doi.org/10.3390/app13106016

[34] Joel Manansala, "Electric Cars in Hot Weather - What You Need to Know," Lectron, April 2023. https://ev-lectron.com/blogs/blog/electric-cars-in-hot-weather-what-to-know

[35] Philippe Novelli, "The Challenges for the Development and Deployment of Sustainable Alternative Fuels in Aviation," ICAO Environment Branch, May 2013. https://www.icao.int/environmental-protection/GFAAF/Documents/ICAO%20SUSTAF%20experts%20group%20outcomes_release%20May2013.pdf

Recommendations for Sustainable Transportation

1. Integration of AI Technology

When exploring potential solutions to overcome state logistics and developing sustainable infrastructure, artificial intelligence (AI) emerges as a valuable tool with diverse applications, as discussed by Thierry Puy - Chief Operation Officer of Vinci Highways (Eastern Europe) - in the QNDCC panel discussion. AI holds the capacity to revolutionize the transport industry by enabling real-time monitoring of traffic congestion, real-time data collection, and effective traffic management. This technological advancement plays a pivotal role in addressing traffic-related challenges and enhancing the sustainability of Qatar's transportation infrastructure. AI's incorporation in transportation aligns with the broader theme of sustainable development discussed at the QNDCC.

There are numerous examples of AI solution adoption and success in the transport sector in Qatar, particularly in the lead-up to the FIFA World Cup Qatar 2022™. The Qatar Mobility Innovation Center (QMIC) partnered with Ashghal and the Supreme Committee for Delivery and Legacy (SC) to develop specific services, applications, dashboards, and analytics to be used for Asghal's operations and maintenance center to monitor real-time traffic and the estimated time of arrival (ETA) of visitors and fans. As a result, Ashghal was able to successfully optimize the timing of traffic signals to avoid traffic congestion. The QMIC also aided in the implementation of an automated parking lot system that monitored the availability of parking spaces in stadiums through cameras powered by AI. The parking information was then integrated into the mobile App "Wain," which successfully alerted people of the real-time capacity of parking lots and guided them to available places.[36] By harnessing AI's power, Qatar can not only address environmental concerns related to carbon emissions, but it can also enhance the efficiency and sustainability of its transportation infrastructure. This innovative approach signifies a commitment to building a modern, forward-thinking society that values sustainability and seeks comprehensive solutions to transportation challenges.

2. Publication of a Sustainable Transportation Policy Framework

Qatar currently does not have a specific policy that compels industries and the public to adopt more sustainable transport modes. To encourage national first steps, it is important to develop and implement clear legislation and policies that define boundaries for sustainable transportation, provide guidance for businesses and the public, and discourage harmful practices. To ensure the development of an optimal policy, Qatar can benchmark internationally implemented policies that have proven to result in substantial success by meeting their targets, such as Bogotá's TransMilenio Bus Rapid Transit (BRT) System, London's Congestion Charge, and China's New Energy Vehicle (NEV) Mandate. Additionally, it is important to meet with national stakeholders from various sectors to discuss their concerns and feedback on the feasibility of this policy and how they would be able to comply. Accordingly, Qatar can start drafting the transportation policy with its stakeholder feedback and national targets in mind to achieve the Qatar National Vision 2030 and beyond. In conjunction with an overarching policy, Qatar can also consider policies and incentives that encourage businesses to prioritize sustainability in their transportation operations, such as requiring companies to phase out large ICE vehicles and replace them with EVs.

3. Intersectoral Cooperation

Sustainable action in a state is conditional upon the willingness of its citizens and businesses to join in the transition. This requisite for collaboration between the public sector and all other actors was a recurring concern in the panel session of the QNDCC. A vital factor to stimulate the private sector is creating a seamless network between the private sector, the public sector, and academia to find a balance between mutual short-term economic benefits and long-term sustainability goals. Such stakeholders include, but are not limited to, transportation operators, warehouse operators, infrastructure operators, cargo owners, environmental organizations, public officials, politicians, industries, R&D organizations, and universities.[37] When experts, government officials, and business actors can collaborate efficiently, sustainable innovation is easier and more likely to occur. This cooperation can align national stakeholder interests and mitigate economic constraints inhibiting sectoral cooperation.

4. Incentivization Programs

To ensure the importance of sustainable transportation and the significance of individual choices is communicated across all industries, Qatar may consider launching comprehensive awareness campaigns that aim to raise awareness about the benefits and importance of sustainable transportation. These campaigns can be developed and launched in accordance with relevant stakeholders, such as the Ministry of Transport (MoT), the Ministry of Environment and Climate Change (MOECC), the Qatar Transportation and Traffic Safety Center (QTTSC), and other potential partners, and they should be strategy based with clear messaging, goals, and call to actions. This campaign can then be cascaded to different ministries and enterprises, as well as educational institutions, to maximize the impact on the public and tailor the campaign to specific audiences.

Based on a local study by Qatar University (QU) professors, it was found that the people in Qatar are generally aware of the benefits and importance of EVs; however, most of the participants stated they were not ready to give up their cars and switch to EVs.[38] This implies that Qatar has to spend more time and resources to set incentives and achieve its goal of having 10% of its vehicles as EVs by 2030. This public sentiment is also present toward the adoption of the public transport system, as most residents in Qatar prefer using their personal cars instead of public buses or the metro. Thus, Qatar's campaigns should focus on stimulating cultural mindset change as the state explores different methods to incentivize people to use public transportation, carpool, and reduce unnecessary travel. Additionally, to motivate people to buy EVs, Qatar can perhaps introduce subsidies and zero-interest loans or exclusive benefits like designated parking areas and free public charging. Qatar can also incentivize local automobile companies to provide their electric models in Qatar or attract more EV-specialized automobile companies to establish firms locally through simplified regulations and announced national benefits, such as possible national discounts on utilities and taxes or subsidy benefits. These recommendations could help Qatar, and states in general, overcome the challenges of changing consumer behavior and limited EV options.

5. Investment in Research

The education sector has been a key tool on the road towards sustainability and tackling climate change in Qatar. QU offers many opportunities for innovation development through its environmental research centers, especially through its Quintuple Innovation Helix Framework – an institutional model that takes into account education, research, services, culture, and the environment. The Qatar Science & Technology Park (QSTP), Qatar Research Development and Innovation Council (QRDI), QTTSC, QMIC, and Earthna also play integral roles in Qatar's environmental RDI ecosystems, as they have contributed towards the creation of a strong network of experts in the areas of energy, environment, health sciences, and information and communications technology that can be utilized to join research efforts toward enhancing Qatar's transportation systems. Specific research topics can include, but are not limited to, climate-resilient infrastructure and technology, sustainable aviation developments, and marine fuel alternatives. These research institutions can collaborate with international partners to track the latest developments and test trials, noting the best possible emerging solutions for Qatar.

6. Pedestrian Friendly Areas

While Qatar has taken active measures to develop pedestrian-friendly and cycle-friendly roads and infrastructures, they can be further improved to become more accessible and usable. The climate of Qatar makes it difficult for pedestrians to walk and cycle for at least 4 to 5 months a year. Accordingly, Qatar can focus on installing shaded structures in pedestrian areas or cycle tracks to encourage more people to use them. Moreover, Qatar can invest in researching different sustainable methods to promote natural airflows through these cycle and pedestrian areas, ensuring that they are suitable for use even in times when the weather is hot and unfavorable. Another potential recommendation is to create an incentivization program that encourages people to cycle walk. This program could be by tracking the miles spent on these tracks and converting them into a material bonus such as utility or grocery discounts.

7. Resource Efficiency

Qatari institutions evidently understand the importance of diversifying the economy while maintaining its global supply of energy and supporting international efforts towards lowering emissions. Since 2012, Qatar has been working toward decreasing energy-related gas flaring and carbon emissions, and it has launched an ambitious climate change action plan – the Qatar National Environment and Climate Change Strategy – which targets a 25% reduction in the carbon intensity of its LNG plants and upstream operations by 2030. Qatar Energy, a key player in the global energy sector and Qatar's local economy, is also focused on driving sustainable energy transition through its transition plan. Its sustainability strategy focuses on three main pillars: climate change and environmental action, operational responsibility, and social and economic development. Its new LNG projects

[36] The Peninsula Newspaper, "Artificial Intelligence sees exponential growth in Qatar," April 4, 2023. https://www.zawya.com/en/business/technology-and-telecom/artificial-intelligence-sees-exponential-growth-in-qatar-d78apgsn

[37] Kinjal J. Shah et al., "Green Transportation for Sustainability: Review of Current Barriers, Strategies, and Innovative Technologies," Journal of Cleaner Production, volume 326, 2021. https://doi.org/10.1016/j.jclepro.2021.129392.

[38] Ahmad Al-Buenain, Saeed Al-Muhannadi, Mohammad Falamarzi, Adeeb A. Kutty, Murat Kucukvar, and Nuri C. Onat, «The Adoption of Electric Vehicles in Qatar Can Contribute to Net Carbon Emission Reduction but Requires Strong Government Incentives,» Vehicles 3, no. 3: 618-635, (2021). https://doi.org/10.3390/vehicles3030037

are expected to produce some of the least carbon-intensive LNG in the world by using advanced gas-fired power plants, efficient Sulphur recovery units, and carbon capture and storage technologies. LNG can be a great alternative to diesel and other fuels, as LNG-powered trucks can decrease CO2 emissions by 10 to 20%, while maintaining a comparable performance to diesel vehicles in terms of power, acceleration, and cruising speed. With the growth of emission control areas (ECAs), LNG is also becoming a popular fuel for marine crafts as it is affordable, dependable, and energy efficient, offering 24% more energy output per ton than heavy fuel oil. Thus, Qatar can explore further opportunities to transition to LNG-reliant national transport modes and consider different energy transition opportunities across its sectors.

8. Sustainable Land, Air, and Maritime Transportation

In alignment with the principles of QNV 2030, which place a strong emphasis on sustainable urban development and integration of land use, transportation systems assume a pivotal role in boosting the utilization of public transportation. Central to this strategy is the promotion of public transport as a practical and convenient mode of travel, fostering the advancement of sustainable transportation. This approach resonates with the concept of transit-oriented development (TODs), a planning concept that promotes an integrated strategy of land use and transportation systems to improve the urban fabric of the cities.[42] The implementation of the Doha Metro, which contains nearly 100 metro stations spread over four primary routes, offers the chance to adopt a wide-ranging TOD approach.[43] By effectively combining land use and transport systems, Qatar can expect to create more sustainable and pedestrian-friendly neighborhoods as more people are encouraged to use transit and the metro for long trips and non-motorized means of transport like bicycles for short trips.

As for air and maritime transportation, Qatar can invest in advancing research on the topic of sustainable aviation fuel (SAF) and how it can become the primary source of jet fuel. The research can also particularly focus on Qatar Airways' plane characteristics and requirements, exploring the steps needed to prepare its air fleet to use SAF. Moreover, Qatar can consider providing incentives to Qatar Airways and Qatar's marine ports to adopt green technologies and more sustainable practices. Such incentives could include tax credits for sustainable practices and government-led investments in environmentally friendly infrastructure. In addition to incentives, Qatar can obligate aircraft departing from Hamad International Airport to "SAF-blended aviation fuel." At the same time, it can urge fuel suppliers of Qatar Airways to increase the share of SAF in jet fuel over the next decade.[44] Moreover, the electrification of airport and marine ground operations can potentially lead to emission reductions and operational cost savings.[45]

[39] Economy Middle East. "Qatar is dealing with its LNG challenges sustainably, intelligently." April 11, 2023. https://economymiddleeast.com/news/qatars-lng-expansion-strategy-scale-partnerships-and-carbon-reduction/

[40] Qatar Energy, "Sustainability Report 2021," 2021. https://www.qatarenergy.qa/en/MediaCenter/Publications/QatarEnergy%202021%20Sustainability%20Report.pdf

[41] Steenkolen Handels-Vereeniging (SHV) Energy, "LNG for Transport," https://www.shvenergy.com/what-we-do/lng/lng-for-transport

Conclusion

In conclusion, this White Paper navigates the critical topic of sustainable transportation, anchoring its analysis in the pivotal discussions held during the third annual QNDCC. By scrutinizing key aspects such as public transport infrastructure, alternative fuels, EVs, and international developments, the paper offers a comprehensive view of the subject with targeted recommendations, supplemented by extensive research. As discussed, there is a keen urgency to reshape global transportation systems to counter climate change, reinforcing the pressing need for sustainable modes that lower carbon emissions. The outlined recommendations, ranging from cutting-edge technology integration to incentivization programs, intersectoral cooperation, and research investments, pave a path for Qatar to emerge not only as a climate-conscious global player but also as a pioneer in sustainable development, aligning seamlessly with its ambitious QNV 2030.

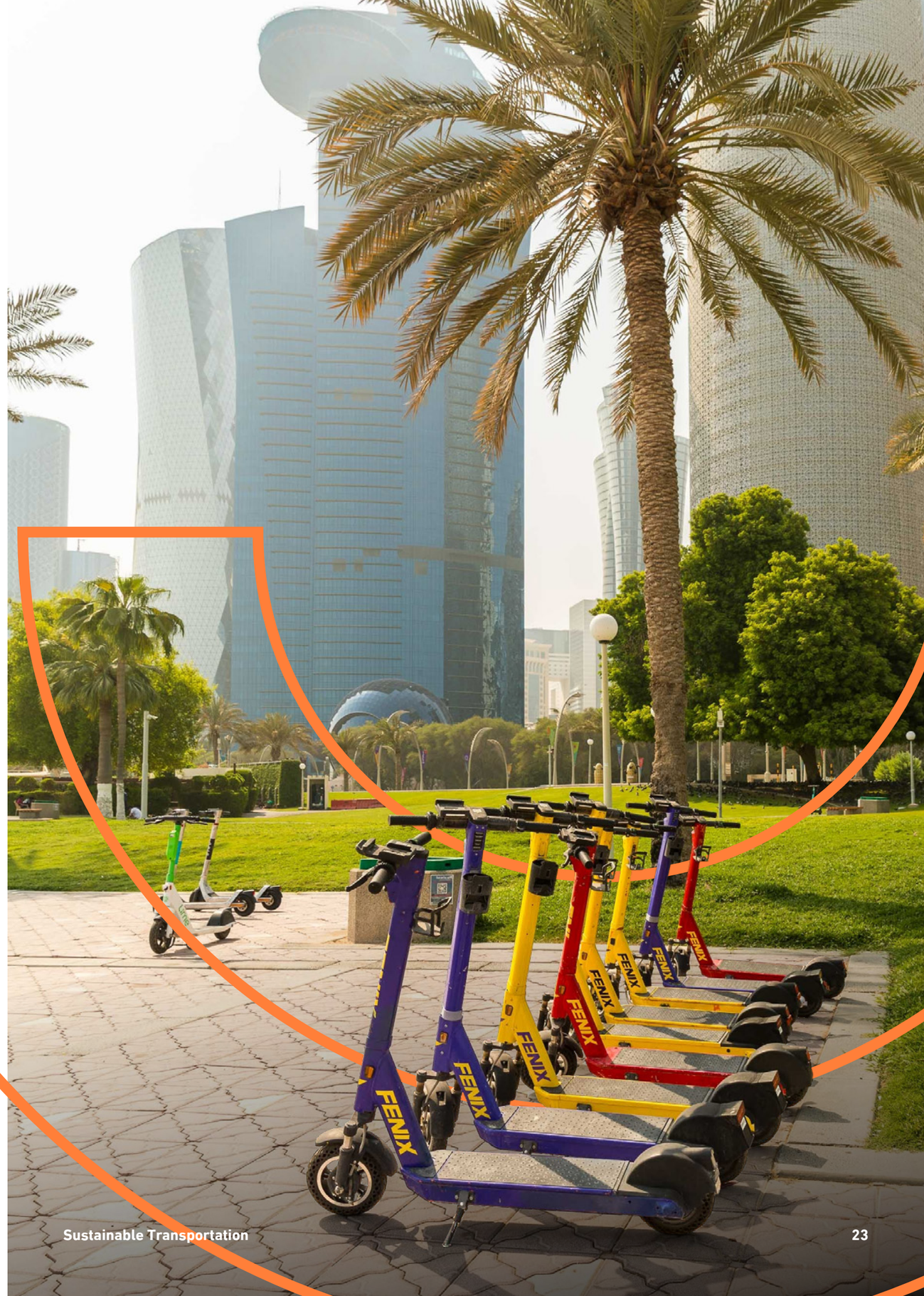
Acknowledgment

The Ministry of Environment and Climate Change and Earthna would like to thank the French Embassy in Doha and the French Business Council in Qatar for their partnership to help bring the 2023 QNDCC to fruition. A special thanks to Qatar National Bank (QNB) for their excellent strategic partnership and support. Finally, Earthna would like to thank the event organizers, volunteers, interns, and moderators who contributed to the success of this year's conference.

We also owe a lot of gratitude to our QNDCC panel speakers who enriched the discourse and provided a forum abundant with novel ideas, collaboration, and innovation. These speakers are: Sheikh Khalifa Bin Ali Al-Thani (EV Expert), Mr. Alex Macheras (Aviation Analyst, Consultant and Advisor), Dr. Shimaa Ali Al-Quradaghi (Director of Qatar Transportation & Traffic Safety Center), Mr. Mohamed Abu Khadija (Director of Strategy, Mowasalat), Mr. Jérémy Caussade (President, Co-Founder, and Chief Engineer, AURA EURO), Mr. Thierry Puy (Chief Operation Officer Eastern Europe, Vinci Highways), and Mr. Paul Bou Chebl (Vice President of Strategy, Alstrom AMECA).

Contributors

Earthna would like to thank the following team from Strategy Hub for their contributions to the development of this report: Leen Al-Rabbat, Amna Al Thani, and Haajerah Khan. Earthna would also like to thank intern Shikha Patel for her assistance in the development of the report.



References

American Journal of Transportation. "Top challenges of sustainable logistics and how to overcome them." June 2023. https://www.ajot.com/news/top-challenges-of-sustainable-logistics-and-how-to-overcome-them

Al-Buenain, Ahmad, Saeed Al-Muhannadi, Mohammad Falamarzi, Adeeb A. Kutty, Murat Kucukvar, and Nuri C. Onat. «The Adoption of Electric Vehicles in Qatar Can Contribute to Net Carbon Emission Reduction but Requires Strong Government Incentives» Vehicles 3, no. 3: 618-635. (2021). https://doi.org/10.3390/vehicles3030037

Al-Harami, Albandari, and Raffaello Furlan. "Qatar National Museum-Transit oriented development: The masterplan for the urban regeneration of a 'green TOD'." Journal of Urban Management. 9(1), 115-136, (2020). doi:https://doi.org/10.1016/j.jum.2019.09.003

Blechinger, Patrycja. "How to reduce the weight of an airplane and CO2 emissions at the same time?" Industry Insider- Aerospace Industry. January 2022. https://industryinsider.eu/aerospace-industry/reduction-of-the-weight-of-the-aircraft/

Bukhari, Irfan. "Public Bus Infrastructure Programme provides integrated transit system." The Peninsula. April 2023. https://thepeninsulaqatar.com/article/01/04/2023/public-bus-infrastructure-programme-provides-integrated-transit-system

Burch, Isabella, and Jock Gilchrist. "Survey of Global Activity to Phase Out Internal Combustion Engine Vehicles." The Climate Center. Last modified March 2020. https://theclimatecenter.org/wp-content/uploads/2020/03/Survey-on-Global-Activities-to-Phase-Out-ICE-Vehicles-update-3.18.20-1.pdf

Calthorpe, Peter. "The Next American Metropolis: Ecology, Community, and the American Dream." (Vol. 1). Canada: Princeton Architectural Press. (1993).

Ceer. "About Us." https://ceermotors.com/about-us/

Economy Middle East. "Qatar is dealing with its LNG challenges sustainably, intelligently." April 11, 2023. https://economymiddleeast.com/news/qatars-lng-expansion-strategy-scale-partnerships-and-carbon-reduction/

European Commission. "Mobility and Transport: Sustainable Transport." https://transport.ec.europa.eu/transport-themes/sustainable-transport_en

Forward, Sonja. "Challenges and barriers for a sustainable transport system – exploring the potential to enact change." TRANSFORUM. May 2014. https://www.diva-portal.org/smash/get/diva2:1051470/FULLTEXT01.pdf

Gnana, Jennifer. "Saudi Arabia wants 30% of vehicles on Riyadh's roads to be electric by 2030." The National News. October 2021. https://rb.gy/9azhna

Gondijian, Garnik, and Cédric Merle. "France's €100bn Recovery Plan: the government strikes a balance between socio-economic emergency and ecological transition." Natixis. September 24, 2020. https://gsh.cib.natixis.com/our-center-of-expertise/articles/france-s-100bn-recovery-plan-the-government-strikes-a-balance-between-socio-economic-emergency-and-ecological-transition

Jacobs, Frank. "EV incentives and city bans in Europe: an overview." Fleet Europe. September 2020. https://www.fleeteurope.com/en/new-energies/europe/features/ev-incentives-and-city-bans-europe-overview?a=FJA05&t%5B0%5D=Electrification&curl=1

Kinjal, Shah, Shu-Yuan Pan, Ingyu Lee, Hyunook Kim, Zhaoyang You, Jian-Ming Zheng, Pen-Chi Chiang. "Green Transportation for Sustainability: Review of Current Barriers, Strategies, and Innovative Technologies." Journal of Cleaner Production, Volume 326. 2021. https://doi.org/10.1016/j.jclepro.2021.129392.

Manansala, Joel. "Electric Cars in Hot Weather - What You Need to Know." Lectron. April 2023. https://ev-lectron.com/blogs/blog/electric-cars-in-hot-weather-what-to-know

Mead, Leila. "The Road to Sustainable Transport." The International Institute for Sustainable Development (IISD). May 2021. https://www.iisd.org/articles/deep-dive/road-sustainable-transport

Novelli, Philippe. "The Challenges for the Development and Deployment of Sustainable Alternative Fuels in Aviation." ICAO Environment Branch. May 2013. https://www.icao.int/environmental-protection/GFAAF/Documents/ICAO%20SUSTAF%20experts%20group%20outcomes_release%20May2013.pdf

OECD. "Transport and the Paris Climate Agreement Reviewing the Impact of Nationally Determined Contributions" [Statutory Report]. 2018. https://www.itf-oecd.org/sites/default/files/docs/transport-co2-paris-climate-agreement-ndcs.pdf

Qarjouli, Asmahan. "Qatar launches its first electric vehicle company with intellectual property." Doha News. June 2023. https://dohanews.co/qatar-launches-first-electric-vehicle-company-with-intellectual-property/

Qatar Rail. "About Metro & Tram." https://www.qr.com.qa/metro-tram?code=AboutMetroAndTram

QFZ. "Advanced Mobility." 2021. https://qfz.gov.qa/wp-content/uploads/2021/08/QFZA-Advanced-Mobility-Booklet_v6-1.pdf

Sharma, Alkesh. "UAE ranks eighth globally in readiness for electric mobility." The National News. September 2022. https://www.thenationalnews.com/business/road-to-net-zero/2022/09/13/uae-ranks-eighth-globally-in-readiness-for-electric-mobility/

Steenkolen Handels-Vereeniging (SHV) Energy. "LNG for Transport." https://www.shvenergy.com/what-we-do/lng/lng-for-transport

United Nations. "World Urbanization Prospects 2018." [World Statistics]. 2022. https://population.un.org/wup/DataQuery/

United States Office of Energy Efficiency and Renewable Energy. "Sustainable Transportation and Fuels." https://www.energy.gov/eere/sustainable-transportation-and-fuels#:~:text=Sustainable%20transportation%20refers%20to%20low,savings%20on%20fuel%20and%20vehicles

The Climate Group. "Our Declaration." https://cop26transportdeclaration.org/en/?contextKey=en

The French Ministry of Ecological Transition and Territorial Cohesion. "National Low Carbon Strategy." March 2020. https://www.ecologie.gouv.fr/sites/default/files/en_SNBC-2_summary.pdf

The Peninsula Newspaper. "Artificial Intelligence sees exponential growth in Qatar." April 4, 2023. https://www.zawya.com/en/business/technology-and-telecom/artificial-intelligence-sees-exponential-growth-in-qatar-d78apgsn

The UN Economic and Social Commission for West Asia (ESCWA). "POLICY BRIEF 10 SDG 7 IN ARAB REGION." https://sdgs.un.org/sites/default/files/2021-05/POLICY%20BRIEF%2010%20-%20SDG%207%20IN%20ARAB%20REGION.pdf

The United Arab Emirates' Government portal. "Sustainable Transportation Plans." https://u.ae/en/information-and-services/transportation/plans-and-initiatives-for-sustainable-transportation

Transport Decarbonisation Alliance. "About Us." https://tda-mobility.org/background/

United Nations Framework Convention on Climate Change Secretariat. "The Paris Agreement." https://unfccc.int/process-and-meetings/the-paris-agreement

United States Environmental Protection Agency. "Electric & Plug-In Hybrid Electric Vehicles." https://www.epa.gov/greenvehicles/electric-plug-hybrid-electric-vehicles

وزارة البيئة والتغيّر المناخي
Ministry of Environment and Climate Change
State of Qatar • دولة قطر

إرثنا earthna
عضو في مؤسسة قطر
Member of Qatar Foundation