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Editorial

Zero-Carbon Vehicles and Power Generation

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In recent decades, traditional fossil fuels such as coal, oil, and natural gas have made the greatest contributions to the economic development of the industrial sector. However, the negative impact of fossil fuel-based energy has also resulted in the pollution of the natural environment, which presents a major threat to long-term growth and prosperity. In response to energy and environmental crises, zero-carbon vehicles and power generation technology are becoming hot topics, in both the industrial and academic communities. More experts and scholars have demonstrated significant and broad influence in their field, and the number of related technical papers is also rapidly increasing. Therefore, we are committed to providing a platform for high-quality papers on research topics including but not limited to the following: renewable energy vehicles, ammonia and hydrogen technologies in power systems, virtual vehicles, thermal power plant peak regulation technologies, etc. The Topic focuses on fundamental and applied research examining the specific impacts of automation on mobility, energy demand, and greenhouse gas emissions. Many up-to-date concepts in technologies designed to accelerate the race to carbon neutrality and sustainable development in vehicles and power systems are explored, discussed, and published as original research papers in this Topic, "Zero Carbon Vehicles and Power Generation".

Wu et al. [1] proposed a novel method characterizing the air backflow of the underhood, in order to improve the thermal efficiency of the air conditioning system (ACS) and reduce the energy consumption of Plug-in Hybrid Electric Vehicle (PHEV). Additionally, a 1D model for analyzing air backflow in the underhood was established and a Computational Fluid Dynamics (CFD) method for calculating air backflow rate and distribution was proposed. It was found that the decrease in the air backflow rate of the underhood helped to improve the refrigeration capacity of the ACS, and, when the backflow ratio cannot be reduced below 10%, the air backflow should be distributed as evenly as possible at the front end of the condenser.

Zhang et al. [2] introduced an analytical model of the voltage source converter (VSC) under the unbalanced condition through mathematical derivations, and the final model was a coupled Thevenin circuit. The proposed model allowed for the direct computation of non-characteristic third harmonics using harmonic power flow studies. The results showed that the VSC, under unbalanced conditions, emitted both positive-sequence and negative-sequence third harmonics, and that the positive-sequence third harmonic was much larger than the negative-sequence third harmonic. It also showed that the unbalanced level and the size of the dc-link capacitor were critical to the level of non-characteristic third harmonics.

Wu et al. [3] proposed and analyzed a multi-source microgrid economic dispatch model to reduce carbon emissions. The implemented carbon trading mechanism contributed to achieving carbon emissions control. Companies with surplus carbon emission quotas can increase their additional income by selling such quotas to reduce the total generation and operation cost of the power system. The low-carbon dispatch model enabled wind power, solar energy, electric vehicles, and other distributed power generation units

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to benefit from carbon trading and to reduce their operation costs while expanding the microgrid system, which ultimately reduced the total cost of the power system.

Guo et al. [4] established a system state equation based on the longitudinal dynamics equation of a vehicle, to deal with the factors influencing electric vehicles when driving under complex conditions. Combined with the improved Sage–Husa adaptive Kalman filter algorithm, a road slope estimation model was established. After the driving speed and rough slope observation were input into the slope estimation model, the accurate road slope estimation at the current time could be obtained. The road slope estimation method was compared with the original Sage–Husa adaptive Kalman filter road slope estimation method through three groups of road tests with different slope ranges, and the accuracy and stability advantages of the proposed algorithm in road conditions with large slopes were verified.

Jo and Kim [5] analyzed the aerodynamic interactions between platooning moving vehicles under different platooning conditions on a freeway. It was found that the effect of the vortex generated by the forward vehicle reduced the value of the stagnation pressure generated at the front of the rear vehicle, which effectively reduced drag on the driving vehicle.

Ji et al. [6] proposed a quantitative evaluation method of driving behavior, based on Naturalistic Driving Studies (NDS) data collected from shared electrical cars and online car-hiring services. In this study, data acquisition, the treatment method, and the data volume verification were analyzed to ensure the effectiveness of the dataset. The distribution characteristics of the main driving behavior parameters were studied. On this basis, the evaluation method was proposed and verified.

Tao et al. [7] presented a novel single-switch high-gain dc/dc converter with a ripple-free input current. The structure consisted of two cells: a coupled inductor cell and a switched capacitor cell. The coupled inductor cell in the proposed converter provided a ripple-free input current. The switched capacitor cell provided a high voltage gain. The converter had a simple control strategy due to the use of a single switch. Moreover, the output capacitor was charged and discharged continuously by a 180° phase shift to eliminate the output voltage ripple.

Ottesen et al. [8] explored consumer preferences for Electric Vehicles (EVs) in Kuwait, in terms of which factors are influential for the 'early majority' (i.e., a part of the general market vs. a niche one) that could influence their purchasing behavior in favor of EVs. A comprehensive and up-to-date picture of the preferences regarding this market was provided, while a variety of valuable promotional tactics were discussed, which may be implemented in conjunction with public incentives and policy changes in the State of Kuwait.

Mišić et al. [9] proposed special energy management for a mountain railway with optimal power distribution and minimum hydrogen consumption. A simulation model was created in a Matlab/Simulink environment for the optimization of hybridized power systems on trains, and it can be easily modified for the hybridization of any type of train. Optimization was performed using sequential quadratic programming (SQP). The results showed that this hybrid train topology had the ability to recover battery and supercapacitor state of charge (SOC) while meeting vehicle speed and propulsion power requirements.

Al-Shami et al. [10] described a novel approach for modeling, identifying, and controlling a running gas turbine power plant. A simplified nonlinear model structure composed of s-domain transfer functions and nonlinear blocks represented by rate limiters, saturations, and look-up tables was proposed. The model was used to design a multiple PI/PD control to regulate the gas turbine via the inlet guide vane and fuel vales, so as to raise and stabilize the compressor's differential pressure or pressure ratio, as well as the raise the set-point of the temperature exhausted from the combustion turbine.

Asiamah et al. [11] developed a hierarchy for understanding the impacts of active and non-active transport modes on the environment and analyzed the adoption of active transportation between older and younger people. The review suggested that the only

active transport modes with no or negligible carbon footprint are walking, running, and swimming, as they do not result in a product that adds to atmospheric greenhouse gasses.

Ma et al. [12] analyzed previous studies and current research on the current technical advances emerging for use in the assisted combustion of ammonia. It was highlighted that plasma-assisted combustion (PAC) was able to change classical ignition and extinction S-curves to monotonic stretching, which makes low-temperature ignition possible while resulting in moderate NOx emissions.

Li et al. [13] developed a new four-component jet fuel surrogate which could satisfactorily emulate the chemical and physical properties of real jet fuel, including the cetane number (CN), threshold sooting index (TSI), molecular weight (MW), a lower heating value (LHV), the ratio of hydrogen and carbon (H/C), and the liquid density, viscosity, and surface tension. Furthermore, a reduced and robust kinetic chemical mechanism (containing 124 species and 590 reactions) that could be directly employed in practical engine combustion simulations was also developed.

Banna et al. [14] used a quantitative descriptive method (with close-ended questions) to collect data from a sample of 227 Kuwaiti nationals who were representative of the owners of half a million internal combustion engine (ICE) cars, categorized as early majority consumers. The findings indicated that over 50 percent of the respondents would prefer to buy an EV in the subsequent three years, when certain criteria were satisfied, including government-controlled pricing policies and recharging point availability, high-speed roads, and free EV-dedicated parking spaces. Furthermore, over 40 percent of respondents stated that they would contemplate purchasing an electric vehicle if the price of gasoline or diesel increased by 19 to 50 percent. The findings also indicated that more than 40 percent of respondents believed that EVs are fire- and crash-safe, and roughly 50 percent of the respondents would be willing to pay between 6 and 20% more for an EV because they believed that EVs are eco-friendlier vehicles and are significantly faster than conventional petrol vehicles.

Nurdini et al. [15] used the open-source R language and the bibliometrix package to carry out a bibliometric analysis of data from 593 scientific publications, taken from Scopus, to investigate the research landscape of electric vehicle waste management. It was revealed that the research area of recycling electronic waste from electric vehicles is still experiencing annual growth that is accelerating rapidly. The findings also indicated that China stands out as the leading contributor to publications, with Tsinghua University being a prominent research institution in this field. In 2023, the most frequently occurring topic was "closed loop", while "recycling" was the dominant keyword.

Hoth et al. [16] evaluated the solar energy potential of parking spaces in Berlin, considering challenges like building and tree shading using digital surface models and weather data for solar simulations. Utilizing open datasets and software, the analysis covered 48,827 parking spaces, revealing that vehicle-integrated photovoltaics (VIPV) could extend vehicle range from 7 to 14 km per day, equating to a median annual increase of 2527 km. The findings suggested possible median yearly cost savings of 164 euros from reduced grid charging, and this study introduced a method to pinpoint parking spaces that are most suitable for solar charging.

Chen et al. [17] comprehensively studied dynamic vehicle data contributing to traffic carbon emissions in terms of data sensitivity and uncertainty. The active subspace method could identify which input parameters were the most important through magnitudes of the input parameter weights, while exploring how the combination of inputs was related to the output of interest, without the expense of multiple simulations. It was concluded that the CO_2 emission factor was most sensitive to the vehicle specific power (VSP). The method has great potential to readily derive the relationship between the combination of inputs and outputs in a complex domain without the expense of multiple simulations. Also, the relationship between the input parameters (i.e., the active variables) and the CO_2 emission factor could be formulated using a quadratic function.

Zhang et al. [18] investigated the effects of bore taper, the starting height of the tapered profile, and ellipticity on the friction power and knocking energy of a piston ring cylinder bore (PRCB) system based on the full-scale test method, and the optimization of the design of the bore profile was carried out with the objectives of minimizing the system's friction power and the peak knocking kinetic energy.

Cardoso et al. [19] proposed an active, purely mechanical solution to the problem of irregular torque production in an alternative internal combustion engine. This solution used an actuator built on a camshaft and a spring, which stored and returned energy during the engine operating cycle, allowing torque production to be normalized, avoiding heavy flywheels.

Huang et al. [20] investigated the synergistic coupling process between the detonation and diesel cycles using gasoline as fuel. A numerical simulation model was constructed to analyze the detonation characteristics of a pulse detonation combustor (PDC), followed by experimental verification, which showed that the generation of detonation waves was influenced by flame and compression wave interactions. Increasing the airflow did not shorten the deflagration-to-detonation transition (DDT) time, whereas increasing the blockage ratio (BR) caused the DDT time to decrease and then increase. Large BRs affected the initiation speed of detonation in the tube, while small BRs impacted the DDT distance and peak pressure.

Liu et al. [21] combined the approaches of bench experiments and numerical simulations to investigate the influence of the injector nozzle diameter on the in-cylinder fuel–air mixture and combustion process, based on a combustion strategy characterized by a high-density and lean mixture. The research provided guidance and suggestions for the selection of an injector nozzle diameter in the development of advanced engine combustion systems.

The papers in this Topic reveal an exciting field, namely "zero carbon vehicles and power generation", which is critical to energy utilization and sustainable development. Pursuing work in this field requires professional knowledge in fields such as energy, fuel, automotives, and power generation. We are delighted to be invited to be the Editors for this "Topic". We have received strong support from professional researchers from many renowned universities and research institutions. We will continue to grow our strengths in order to make a greater contribution to carbon neutrality goals. We firmly believe that, through continuous collaboration among all researchers, these steps will help resolve global challenges and address energy sustainability at the source. We hope that this "Topic" will help bring the research community closer together. Finally, we would like to thank all authors, reviewers, and editors who contributed to this publication. We believe that the readers of all the journals involved in this Topic will find these scientific manuscripts interesting and useful for their future research efforts.

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