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Editorial: Pathways to resilient zero carbon cities

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Editorial on the Research Topic

Pathways to resilient zero carbon cities

Due to the increasing risks from global warming, optimizing our cities to cut carbon emissions to zero before 2050 is seen as one of the prerequisites for a sustainable world. In response to this challenge, a number of world cities have declared carbon emergency and an aspiration to achieve zero emissions, in some cases as early as 2030. However, there are no clear pathways towards this goal. Simultaneously, all cities were caught unprepared by the COVID-19 pandemic in 2020, testing their resilience to extremes. As the worldwide urban population is expected to grow to nearly 70% by 2050, there is an overwhelming case for improving our future by transforming cities into resilient zero carbon communities.

Increasingly, there is a need for more research into urban resilience that includes communities, policy, and environmental and physical elements of cities. This Research Topic starts addressing this need by assembling an international group of researchers, designers, and experts to exchange knowledge on the complex issues of multiple pathways towards resilient zero carbon cities. Building on the insights from the *Pathways to Resilient Zero Carbon Cities* (RZCC-2021) conference, this Research Topic aims to consolidate the state of the art and establish a trajectory of the future developments in the field.

In “*Systemic Perspectives on National Infrastructure for a Sustainable, Resilient Net Zero Future*” by [Tom Dolan](#) we learn that all sustainability and resilience challenges are interdependent emergent properties closely linked to national infrastructures. Thus, infrastructure has a synergistic leverage point for a sustainable resilient net zero future. The paper looks into the requirements for a systemic transformation of the infrastructure that will be required to achieve this leverage.

“*How can UK Housing Projects be Brought in Line With Net-Zero Carbon Emission Targets?*” by [Jankovic et al.](#) is a question asked by Ljubomir Jankovic, Purvesh Bharadwaj and Silvio Carta arising from two conflicting sets of circumstances: on the one hand, numerous UK local authorities have declared carbon emergency, aspire to reach carbon neutrality well before 2050, but on the other hand at the time of writing, houses were being constructed according to outdated regulations. Whilst there is increasing focus on

operational emissions, this research reveals that emissions embodied in building materials could lead to an overshoot of net-zero targets by three decades.

“*Developing Resilience to Emergencies: Evaluation of Thermal Indices and Outdoor Comfort Before and During the COVID-19 Pandemic*” by Timothy O. Adekunle reveals that the reduced use of transportation and consequent reduced emissions and pollution during the pandemic resulted in higher outdoor temperatures in comparison with the previous year before the pandemic. This reveals an interesting paradox: reduction of global emissions is considered to be an answer to increasing global temperatures, yet as result of reduced emissions during the pandemic, the external temperatures increased in the study area. This research therefore highlights the complexity of interconnected factors that need to be taken into account in order to get climate change under control.

“*Resilient Communities: A Novel Workflow*” by Carta et al. analysed successful sustainable communities and extracted information about daily routines, from which a set of key successful aspects emerged. Patterns and correlations in the success of existing communities were established and applied in practice. The study illustrated a potential for this novel workflow that revealed information not directly visible from the maps or from other resilience frameworks. The results of this study are considered to be instrumental in identifying key aspects of the built environment that have significant impact on urban communities.

In “*Integrating Artificial Urban Wetlands Into Communities: A Pathway to Carbon Zero?*” by Rogerson et al. investigated the barriers to implementing artificial urban wetlands, known to be an optimum natural environment for the sequestration and long-term storage of carbon dioxide. Despite numerous uncertainties to identify generic conclusions, the specific study identifies a multi-domain approach as a way forward, where carbon storage is combined with food production, natural flood barriers and other coinciding benefits.

The quest towards resilient zero carbon communities often comes to a barrier of how we are going to pay for it. Whilst the notion of money as it is rarely questioned, “*Solar Dollars: A Complementary Currency that Incentivizes Renewable Energy*” by Thomas H. Greco Jr investigates how value creation using solar radiation could incentivise the shift towards renewable energy and enable decentralisation of economic and political power using alternative currencies. Soar Dollars are created by a utility company through energy production and circulation of the corresponding value as payment for electricity or other services at a local level. In the absence of sufficient quantities

of conventional money to pay for transformation towards resilient net zero cities, this could be an answer to how value could be generated through alternative means to pay for such transformation.

In “*Cumulative embodied and operational emissions of retrofit in Birmingham Zero Carbon House*” by Jankovic et al. revisit the negative operational emissions in the Zero Carbon House established through instrumental monitoring and put the house under the lens of embodied emissions. The savings from retrofitting this 170-year old house did not require upfront carbon used for its construction to be taken into account, thus achieving total zero emissions in the first 2 years. Retrofitting more recent houses would take longer to achieve total zero emissions and would require a scaled up national approach predicated on a significant financial expenditure and embodied emissions over the next three decades.

Whilst the above is a small subset of the research field, it illustrates the scale of efforts needed to be deployed to create pathways to resilient zero carbon cities. It also demonstrates that this remains to be one of the toughest open problems in today’s world that requires innovative thinking in which nothing should be taken for granted and nothing should be off the agenda.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

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

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