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Editorial: Renewable energy systems for sustainable cities

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Editorial on the Research Topic
Renewable energy systems for sustainable cities

Human society strives to get the desired comfort for maintaining high standards of living. The Life Quality Index (LQI) measures the quality of life and wellbeing of the citizens of a country. One of the recent major developments in urban cities is the increase in energy consumption derived from fossil fuels, which are mostly used for transportation, domestic and commercial buildings, and industries. However, the fossil fuelled energy systems negatively contribute to air pollution as these systems emit unacceptable levels of particulate matter, carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NOx), and greenhouse gases (CO_2, N_2O, and CH_4), which affects citizen health resulting in a poor LQI and hence, unsustainable urban development. In addition to this, the steep rise in the cost of energy would negatively affect the per capita energy consumption. Fossil fuel reserves are limited and resulting in energy supply crisis. Hence, the use of renewable energy is the key for development of sustainable cities.

Modern smart cities require more energy that has to be generated using renewable energy sources and simultaneously keep the environment clean. The fossil fuel-based transport sector is currently in a transition phase, as it transits to zero-emission vehicles (electric vehicles/hybrid vehicles/fuel cell vehicles) with the use of electricity and hydrogen, which may be derived from renewable energy sources. Domestic and commercial buildings should be supplied renewable energy derived from biogas/bio-synthesis gas, which may be produced from urban wastes collected from houses, airports, railway stations, bus stations, restaurants, shopping malls, hostels, etc. The building energy requirements for cooling, heating, and lighting shall be met using rooftop solar photovoltaic systems and heating through solar heaters (decentralized renewable energy sources). City energy needs shall be provided by the centralized renewable energy systems (solar photovoltaic, wind, bioenergy, etc.), as shown in Figure 1.

Energy is in a transition phase from conventional to clean and renewable energy. Renewable energy use is the key factor in mitigating air pollution in urban cities. Hence, the Research Topic "*Renewable energy systems for sustainable cities*" was aimed to bring the development of suitable renewable energy technologies as well as innovative ideas on a common platform for effective implementation in cities.

In this context, Frontiers in Sustainable Cities invited original research/review articles (mainly energy-related) on the development of sustainable cities using renewable energy. Fair participation of articles was observed from various countries. We are happy to announce the four papers, which have been included in the special topic edited are listed below.

Sustainable energy means energy which is eternal in nature and does not affects the nature after use. Many energy sources including solar, wind, hydro and biomass are sustainable in nature, but they have their own limitations like energy density and quick production. The nuclear-renewable hybrid energy can bridge this gas of energy density and fast production. Arefin et al. carried out review work on "*A Comprehensive Review of Nuclear-Renewable Hybrid Energy Systems: Status, Operation, Configuration, Benefit, and Feasibility*" and reported that two carbon-free technologies, renewable energy, and nuclear energy, can be integrated and form a nuclear-renewable hybrid energy system (N-R-HES). The possible integration techniques in operation and benefits of N-R-HES included interconnections of six energies electrical, thermal, chemical, mechanical, hydrogen, and information. Apart from various aspects relating to the reactor licensing, and permitting procedures along with the different benefits of N-R-HES, further systems analysis, technical development and optimization of the concepts, and analysis of economic viability are necessary.

The solar energy harvesting is on boom, but there are cost-benefits issues on rooftop solar PV systems. Cost-economical aspects and Govt. policies may favor the better inclusion of Solar PV systems by common people. McKay and Hendricks, carried out work on "*Pitiful rooftop solar uptake in sunny South Africa: A policy, funding, and service delivery perspective*". They reported the rolling blackouts, high electricity prices, a favorable climate, and the size of the South African economy, are some favorable factors for adopting the rooftop photovoltaic (PV) solar products for the low levels of the middle-income residential market. On the contrary, other factors like expensive rooftop PV due to costly batteries and inverters, and non-existent tax rebates, subsidies, and poor banking support are creating hindrances. They suggested that rooftop PV companies should work with banks to offer innovative, cost-effective modular PV packages, and build their brand to create a relationship of trust with the community to increase sales.

In any sustainable city energy infrastructure paly a major role in production and distribution system. Jewell et al. carried out research work on "*Designing a district energy infrastructure - a case-study in Lisbon*". They described a case study on the design of district energy infrastructure for the green-field project of the Vale de Santo António (Lisbon, Portugal). The study illustrated the high impact of building renovation on heat demand and the existing potential for a two-layout network to minimize pumping demand and heat distribution loss. Further, they suggested to study on a sensitivity analysis with regard to future carbon tax changes and electricity greening concludes that an electricity-based heating mix is optimal.

Rail transportation sector is major consumer of electricity. The sustainable source of energy would help in providing renewable energy to the rail transportation system and development of sustainable cities like metro rail system. Any technology helping in energy saving and improvement in energy efficiency also welcomed for sustainbel development of cities. Premsagar and Kenworthy presented "*A critical review of hyperloop (ultra-high speed rail) technology: Urban and Transport Planning, Technical, Environmental, Economic, and Human Considerations*". They reported that companies globally have been trying to work on high-speed (HS) ground transportation. The work on an ultra-high-speed rail (UHSR), hyperloop is in progress, where rail service operates at a potential speed of 1,200 km/h. They reported the key technical, environmental, economic, and safety considerations in assessing the applicability of the hyperloop to a particular location. But, the hyperloop technology is still under trial and thorough testing of prototype systems in different conditions is required. The development and construction costs of the hyperloop in the foreseeable future need to be tested for techno-commercial feasibility at large.

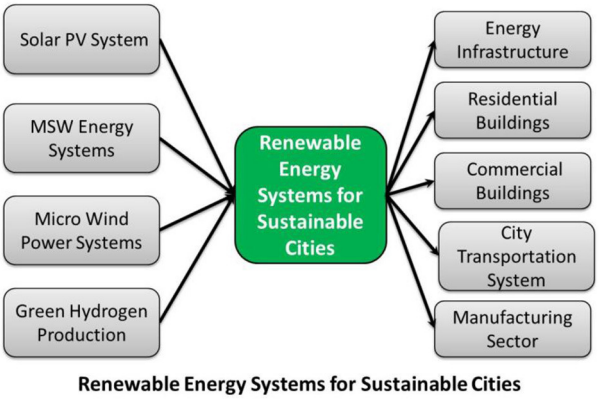

FIGURE 1
Framework for renewable energy systems for sustainable cities.

Author contributions

KAS prepared initial idea and concept note, guided and helped in editing manuscripts, and prepared editorial comments. BLS helped in preparation and finalization of concept note, edited manuscripts, and prepared editorial comments. Both authors contributed to the article and approved the submitted version.

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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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