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EDITORIAL COMMENTARY

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# Little time left to reverse emissions—Growing hope despite disappointing $CO_2$ trend

The 2018 Intergovernmental Panel on Climate Change (IPCC) Special Report (Intergovernmental Panel on Climate Change, 2018) concluded that even if the global community is able to keep temperature change below 1.5–2.0°C by the end of the 21st century, the impacts on global ecosystems are likely to be profound. The message of that report echoed a deep concern on the future, if the emissions could not be put on a downward track to reach the goals of the Paris Climate Agreement from December 2015 (Paris Agreement, 2015). The scientific foundation of the urgency to cut emissions is univocal. The urgency of actions was recently captured by a statement of Hans Bruyninckx, the Executive Director of European Environment Agency (EEA), who said "We have a narrow window of opportunity in the next decade to scale up measures to protect nature, lessen the impacts of climate change and radically reduce our consumption of natural resources" (European Environment Agency, 2019).

Our political systems have unfortunately not been able to properly respond to the "climate-SOS" signaled by the scientific community, individuals, and businesses. The latest stand of global emissions indicates that we are far above the critical path and that the global temperature may rise by 3.2°C. The greenhouse gas emissions briefly stabilized during 2014–2016, but they are again on rise. Year 2019 as well as the last year 2018 will be record years in emissions. These are alarming news because every year of postponing emission cuts will mean that faster and steeper cuts will be necessary in the coming years. The UN Environmental Programme estimates that the required cuts in emissions are now 2.7% per year from 2020 for the 2°C goal and 7.6% per year on average for the 1.5°C goal (UNEP, 2019). The magnitude of the cuts required may grow to such a level, if the emissions will not turn downwards, that our economic systems may be unable to handle such rapid changes.

Had we succeeded to peak the emissions 10 years ago, the required cuts would have been 0.7 and 3.3% per year on average (UNEP, 2019). The message is clear: the time to prevent the climate catastrophe is running out. There is little time left to act. We have to do our outmost to keep the carbon out of the atmosphere, but we may need soon to voice stronger for adoption measures as well to mitigate the consequent human catastrophe ahead.

But there are a number of positive developments that raise hope that we could still have chances to win the climate combat. Importantly, the political awareness of people around the world is increasing demanding those in power to undertake the necessary steps to cut emissions. Youth around the world are standing loudly up to protest laissez-faire politics. In Europe, the climate is a major theme in parliamentary elections, and the new European Commission has promised to cut emissions beyond the earlier plans and establish a European Green Deal policy soon. Similarly, the bold policy portfolio adopted by New York City for its own "Green New Deal" underscores the vitality of American subnational efforts despite national policy failure.

On the front of clean energy technologies, very positive developments are witnessed. Cost reductions have now led to a positive "tipping point": clean energy is in many cases and places cheaper than traditional energy, in particular in electricity generation. We are about to enter a subsidy-free era of renewable energy which together with energy efficiency measures could cause major emissions cuts necessary in the coming decades.

Climate change mitigation has and needs to continue a focus on coal and oil, that is, on the main fossil fuels for power production and transport, which constitute most of the energy-based emissions. Here, electrification is becoming an important strategy to drive $CO_2$ emissions down, thanks to solar, wind, and battery technologies, among others, which are starting to replace fossil fuels as mainstream options. Coupling cheap and clean power to other sectors such as transport and heating and cooling is gaining momentum in energy-climate policies as well. Quicker action and greater emphasis is needed here.

*Wiley Interdisciplinary Reviews: Energy and Environment* has been committed throughout its existence to publish reviews and focus articles to address the climate challenge and to provide new insights for better mitigation strategies. Through its multidisciplinary character, the journal has the capability to address complex issues that define global grand challenges such as energy and climate. The journal has aimed to invite thinking that can facilitate broader approaches than traditional, siloed science subjects.

  

In 2019, we have published several interesting papers that cover topical fields in energy and environment. We see a major growth of papers on integration of renewables into the existing energy systems and on different systemic issues, which are becoming vital when the share of variable renewables grows. The theme of integration touches not only technical systems and their new requirements (Lind, Cossent, Chaves-Avila, & Gómez San Román, 2019; Sajadi, Strezoski, Strezoski, Prica, & Loparo, 2019), but also the planning of future energy systems (Doubleday, Hafiz, Parker, et al., 2019; Helistö, Kiviluoma, Holttinen, Lara, & Hodge, 2019), necessary market reforms and regulation (Algarvio, Lopes, Couto, Santana, & Estanqueiro, 2019; Skytte & Bobo, 2019), and new technologies such as power-to-gas to master large volumes of wind and solar power (Ajanovic & Haas, 2019). Invited papers have dealt on nationwide analytical scale with macroscale limitations and opportunities (Guminski, Böing, Murmann, & von Roon, 2019; Li, Zhang, Chen, & Lu, 2019). And important work at the local level on transformative change in energy-environment-society relationship shows that pioneers of some of the sharpest emissions cuts are found in city and regional endeavors (Taminiau, Bleviss, Banks, & Byrne, 2019).

Papers on energy development in Asia are of special interest, as most of the new emissions will originate from this region. Understanding the energy development challenge and opportunities for clean and efficient energy in India (Bardhan, Debnath, & Jana, 2019; Singh, Henriques, & Martins, 2019) and China (Li et al., 2019; Liu, Shen, Price, et al., 2019) would in this context be of high priority, and for this reason are being sought by the journal. The lessons learned from Korea on linking clean energy to a green economy provide guidance to future policies intending to leverage on renewable energy investments (Ha & Byrne, 2019).

Many emerging economies have still underdeveloped energy infrastructures unable to provide energy services to millions of people, not to speak of providing energy in a sustainable way. *Wiley Interdisciplinary Reviews: Energy and Environment* has devoted a Special Collection of papers to address the sustainable energy issue in these countries. Rural electrification (Bisaga, Parikh, Mulugetta, & Hailu, 2019; Domenech, Ferrer-Martí, & Pastor, 2019) is a key area in this context. There is also a lack of studies concerned with better understanding the energy systems in Africa and South America, which could also have a material effect on climate mitigation (Machado et al., 2019).

*Wiley Interdisciplinary Reviews: Energy and Environment* also publishes topical reviews on key sustainable technologies such as bioenergy and biofuels (Iliopoulou, Triantafyllidis, & Lappas, 2019) and wind power (Tuinema, Getreuer, Rueda Torres, & van der Meijden, 2019). In 2019, a collection of papers from past journal issues on renewable energy integration was compiled together into a book with the title Advances in Energy Systems: The Large-scale Renewable Energy Integration Challenge (Lund, Byrne, Haas, & Flynn, 2019). This book provides a strong multidisciplinary view on how to handle issues on technologies, systems, markets, and policies in a clean energy transition with much renewable energy. The previous book with similar format was published in 2016 and dealt with the sustainability challenge of bioenergy (Lund, Byrne, Berndes, & Vasalos, 2016). We expect to continue publishing reference works based on *Wiley Interdisciplinary Reviews: Energy and Environment* articles in the future as well.

As *Wiley Interdisciplinary Reviews: Energy and Environment* begins its ninth year, we warmly thank the research community, reviewers, editors, and publisher for their valuable efforts. But we would also like to remind everyone about our responsibility to find solutions that cut emissions deeper and faster. The climate crisis has reached the stage where we must act boldly and this demands research that aggressively pursues disruptive technologies, policies, and economics.

## CONFLICT OF INTEREST

The authors have declared no conflicts of interest for this article.

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