

# Online Meetings in Times of Global Crisis: Toward Sustainable Conferencing

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International conferences are an essential component of the timely exchange of ideas and results in the scientific community, where scientists present their results, gain new insights, and meet colleagues and collaborators. In early 2020, a global pandemic caused by a coronavirus (SARS-CoV-2) and the corresponding disease (covid-19) resulted in a number of conferences being canceled or postponed.<sup>1</sup> To foster scientific exchange despite the restrictions, a range of initiatives were launched across the globe to move international conferences online.<sup>2–8</sup>

*The Perils of Traditional Scientific Meetings.* Sharing knowledge is an imperative for scientists. This process leads to communicating results, findings, observations, and views arising from the research activities.<sup>9</sup> For scientific activities to become part of the shared body of knowledge, a formal communication process is an integral component of science. Communication, reputation, and impact are thereby important drivers of scientific progress.<sup>10</sup> There are two main channels of formal scientific communication, which are either written or oral. While written communication comes in the form of scientific papers, oral communication occurs mainly during scientific conferences (Figure 1, left). Both channels have a long tradition, and papers published in scientific journals are the most dominant format in which scientific knowledge resides. However, over the last few decades, the advent of digital media and communication has dramatically transformed the means and pace of scientific publications. The leading scientific journals publish papers in a more accessible way, including attractive formats that appeal to general readership.<sup>11</sup>

On the other hand, the format of scientific conferences has practically remained unchanged despite the digital revolution. At the same time, the number of conferences increased dramatically with the extended connectivity and travel. In the late 20th century, scientific conferences consisted mostly of large regular events joined by the entire scientific community. However, since 2010, the combination of several factors, including the ease of launching a conference, the appearance of new and rapidly expanding topics, such as perovskite solar cells, along with the extraordinary growth of the scientific system in Asia, led to an increase in the number of conferences, which has in turn affected the rate of international travel.

The scientific community has long been pointing out the negative impact of intense professional mobility. For instance, Sir Fraser Stoddart, professor at Northwestern University, reported that the number of his international travel appointments increased from around 20 to more than 60 per year after

receiving the 2016 Nobel Prize.<sup>12</sup> These are exceptional travel schedules. Scientists at the professor level emit on average around 11 tons of CO<sub>2</sub> per year, and around 4 tons at a student level.<sup>13</sup> This is unsustainable, especially for a community that works on shaping the future of our planet. As mobility becomes increasingly important for scientists, they are often viewed as global nomads,<sup>14</sup> living between international meetings, seminars, and conferences on flights and train rides throughout the year.<sup>15–17</sup> We are only beginning to grasp the implications of such a lifestyle on our carbon footprint, equal opportunities, and personal well-being, including work–life balance.<sup>15–17</sup>

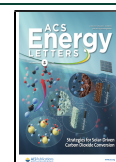
Traditionally, attending a scientific conference has been a matter of high professional importance and personal excitement. However, this format is presently questioned by the community. Apart from the large carbon footprint associated with the international flights, most international conferences remain scarcely accessible to a wide set of researchers, including persons with disabilities and those with limited resources or having caring and family commitments. This further reduces the capacity for frequent communication with a broader audience, unless one continuously attends events, which in turns stimulates competition to attract prominent invited speakers, leaving declined invitations to be even perceived negatively. As a result, most invited speakers often belong to the same pool of scientists, and thus, speaking at more conferences does not necessarily result in higher visibility. Therefore, attending conferences becomes a challenging enterprise, consuming time and resources, whereas professional benefits are not always apparent.<sup>14</sup>

*The Emergence of Online Conferencing.* In the time of worldwide confinements disrupting travel plans, it comes as no surprise that the scientific community has been striving to find an alternative. This has been particularly important toward the efforts to minimize the environmental impact of travel.<sup>15–18</sup> Since major scientific meetings and conferences have been canceled or postponed, such as those of the Materials Research Society (MRS), American Chemical

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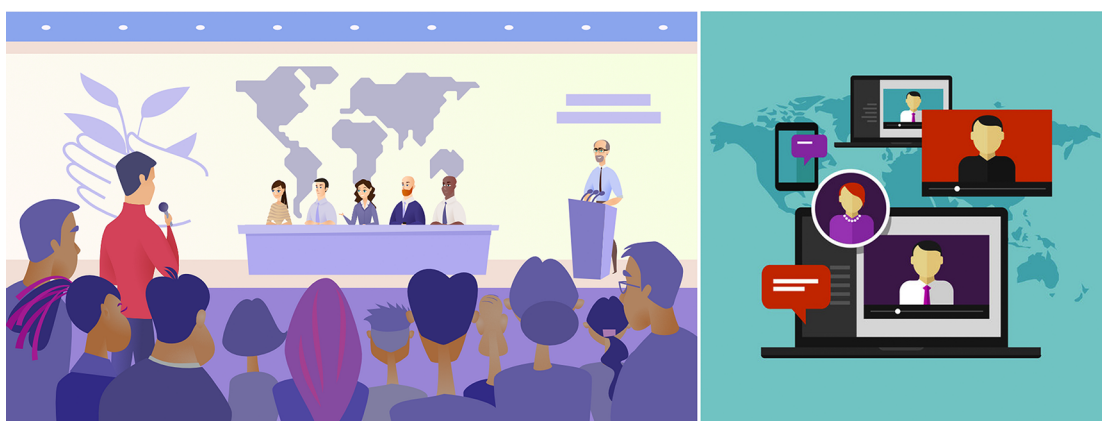


Figure 1. Left: Scientific communication at international conferences. Copyright: teravector@123RF.com. Right: Online Conferences. Copyright: Bakhtiar Zein, 123RF.com.

Society (ACS), as well as Gordon Research Conferences (GRC), more representatives of the community moved their international activities online (Figure 1, right).<sup>4–7,19–21</sup> This provided a unique learning opportunity for students and researchers, along with the possibility to explore various research areas remotely.

There has been an effort from the energy research community in this direction. In particular, the nanoGe platform has organized a new series of online meetups that gathered the photovoltaics community,<sup>2</sup> along with the first virtual perovskite conference (ViPerCon) that took place in April 2020,<sup>3</sup> jointly bringing together more than 1200 attendees worldwide over several days of online seminars (Figure 2). This provided a new stage to meet and exchange



Figure 2. Impressions from the nanoGe Online Meetups and the ViPerCon. Image Credit: @nanoGe\_Conf.<sup>22</sup>

ideas, typically opening with lectures of some of the leading experts in the research field, followed by a moderated Q&A session and ePoster presentations. The talks and Q&A took place in a video chat platform with questions submitted in writing and a moderator managing the logistics. The online

poster sessions were placed in a separate chat platform that enabled discussion between participants.

A few early lessons learned suggest that the talks were more effective if comparably short in this format, and that Q&A in a panel setting works very well. On the other hand, when scheduling virtual events, it has been proven necessary to carefully consider the differences in time zones, which can be a drawback for some participants, as keeping the attention on the screen for a long period of time during very early or late hours is particularly demanding. In this regard, the digital environment also requires an attractive and interactive format because of the ease of leaving the virtual space with a “click”. Some of the limitations of online conferences have also been the absence of contributing talks that would broaden the scope and give more opportunities to early-career researchers. In addition, one of the main challenges is to enable the interaction between participants that is at the heart of scientific conferences, where social life, informal discussions, and more personal exchanges generate essential contacts and cooperation, enhancing the scientific activity and research progress in general. While these personal interactions cannot be substituted, online conferences provide a unique opportunity to complement traditional conference formats while upholding the benefits<sup>23</sup> of presenting and receiving feedback, keeping up with cutting-edge research, sharing research insights, and having the opportunity to be exposed to inspiring ideas and people, as well as maintaining the sense of community.

This stimulates a number of online initiatives, including short professional meetings that concentrate on particularly interesting research topics, such as those organized by the nanoGe Online Meetups,<sup>2</sup> as well as the continuation of earlier online events that are increasingly important, such as the RSC Twitter Posters.<sup>20</sup> Furthermore, major events have moved online to maintain the sense of rich scholarly days of traditional conferences, such as the 12th Conference on Hybrid and Organic Photovoltaics (HOPV) that has been transformed into the HOPV20 Online Conference.<sup>24</sup> This effort is complemented with other educational programs, including webinars and courses, along with scientific discussions hosted by local research institutes, which have been substituted by video conferencing, opening them to the global scientific community. These online activities are shaping scientific communication beyond the traditional format.

*What We Learned Moving Forward.* Following the experience of online conferences, it has become clear that international

gatherings can take place online without compromising the quality of the scientific exchange (Figure 3). Some of the



**Figure 3. Online conferencing.** Copyright: Andrii Torianyk (left) and Anastasiia Nevstenko (right), 123RF.com.

presentations, such as the online posters, are even enhanced by the multimedia content (e.g., video presentations). Moreover, the online events have proven to be more accessible, providing the opportunity for a greater number of researchers across the globe to attend at affordable prices and with minimal carbon footprint. This factor has brought a more diverse community together, including those who often do not have the resources to undertake long and expensive intercontinental journeys or cannot attend because of family care or other responsibilities. Finally, the interaction between the speakers and the attendees appears to be facilitated online as compared to in-person conferences, with many more questions following the talks and panel discussions. Each talk sparked more questions than there was time to answer them. Presumably, the somewhat less personal interaction lowers the barriers for the intimidating act of asking a question. While one-on-one discussions and direct personal exchanges remain more challenging in the early online formats, further advancements might be able to overcome this obstacle as well.

All in all, online conferences are not likely to entirely replace in-person meetings. However, a global crisis has created another stage for emerging online tools that have the potential to dramatically reduce the scientific “travel circus” and provide a more accessible, inclusive, and diverse platform for scientific exchange. This progress could be further enhanced by the development of digital technologies (e.g., virtual reality) and introducing “hybrid conference” events including both in-person and online sessions. We hope that the community uses this momentum to transform the conference experience in the future.

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## Notes

Views expressed in this Energy Focus are those of the authors and not necessarily the views of the ACS.

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