

Democratizing Sustainable Energy Technology through Collaborative International Spaces

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Executive Summary: Reliance on fossil fuels has exacerbated climate change and created geopolitical instability. As seen recently with Russia's invasion of Ukraine, key players in the energy sector often exert outsized influence on sovereign states and world markets. The ongoing sustainable energy transition provides an opportunity to change the geopolitical influence of these states while limiting global warming. Countries have an opportunity to use diplomacy to increase the diffusion of renewable energy technologies, particularly to developing countries. This can both reduce the inflated influence of fossil fuel producing states on the global stage and achieve a net zero (NZ) world. In anticipation of this latter transition—and to promote growth in energy diplomacy—we propose two UN initiatives: a multilateral energy research and storage collaborative, the World Institute for Energy Storage (WIES), and the biennial International Renewable Energy Conference & Expo (IRECE).

I. Introduction

i. The urgent need for renewable energy diplomacy

Fifteen countries control over 65% of the world's natural gas, oil, and coal reserves, giving these key players disproportionate influence over nations that import these fossil fuels (IEA 2021b). Energy diplomacy has traditionally been a means of developing and maintaining relationships with states controlling fossil fuel resources but has required compromising on other policies. This was evident in Russia's attempt to leverage European dependence on its natural gas exports to weaken the European response to the invasion of Ukraine. In addition to being a geopolitical vulnerability,

reliance on fossil fuels is spurring climate change. Global greenhouse gas emissions and the corresponding climate trajectory are expected to result in an 11-14% loss in real GDP by 2050 relative to a world without climate change (Guo, Kubli, and Saner 2021, 1), making it a major concern for all government. Yet despite the dramatic consequences, there has been limited action to achieve NZ. To date, the renewable energy supply (e.g., wind, solar, hydropower) is far below the 52-67% needed by 2050 to limit global warming to 1.5°C and mitigate the effects of climate change (Rogelj et al. 2018). Meeting these targets will require a global effort.

Two major obstacles hinder the growth of renewable energy globally: 1) developing scalable energy storage solutions, and 2) improving knowledge transfer between countries and actors with improved energy technologies and those without.

First, scientific advances have made some renewable energy technologies competitive with fossil fuel in terms of efficiency (Hayat et al. 2019, 4). However, problems remain in providing a consistently available energy supply from intermittent renewable energy sources. Energy storage technologies provide the necessary flexibility to support deployment of renewable energy sources in a variety of environmental conditions. In fact, to meet a NZ 2050 scenario, estimates suggest that energy storage capacity will need to increase by 38% annually (IEA 2021a), demonstrating a need to develop energy storage technologies suited to a wide range of economic and environmental scenarios.

Second, developing countries present a considerable opportunity to expand renewable energy supply. As of 2020, 733 million people, largely in sub-Saharan Africa, did not have access to electricity (World Bank 2022, 25). As access to electricity expands, there is an opportunity to meet increased demand by expanding the global renewable energy supply, which will additionally improve energy independence. Developing countries are also estimated to bear some of the greatest consequences from not achieving a NZ scenario due to geography and low income, despite having contributed the least to the problem (Kemal Dervis 2007). Yet a lack of critical resources such as technical knowledge and funding present challenges to implementing renewable energies in these nations. Overcoming these obstacles to navigate a global energy transition requires international collaboration between policymakers and scientists.

ii. A critical role for science diplomacy

Previous multinational efforts have proven successful in developing collaborations between scientists and policymakers that can serve as a model for renewable energy diplomacy. For example, the European Organization for Nuclear Research (CERN) is a multinational physics lab that is home to the world's largest particle accelerator and the birthplace of the internet. The development of CERN was inspired by the need to quickly share

information with scientists across the globe (Lucibella 2014; Höne and Kurbalija 2018), and it was used as the blueprint for SESAME, the Synchrotron-Light for Experimental Science and Applications in the Middle East. Thanks to SESAME, traditionally mutually antagonistic nations built a synchrotron light source, demonstrating both the scientific and diplomatic potential of multinational research institutions (Höne and Kurbalija 2018; Lucibella 2014). To date, there are no multinational efforts in the mold of CERN or SESAME dedicated to developing the accessible, affordable, and flexible energy storage technologies necessary to ensure even distribution of renewable energy technologies across the globe. We thus propose WIES, a multinational research center whose goal will be to develop scalable, open-source energy storage solutions.

A second hurdle is poor communication between scientists and policymakers. For example, decarbonization plans outlined in the 2021 Glasgow Climate Pact have been criticized by scientists for failing to limit global warming to 2°C above pre-industrial levels (Masood and Tollefson 2021). Further examples of science communication failures have been seen throughout the COVID-19 pandemic, with focus on single-study results and insufficient emphasis on peer-reviewed research (Strazewski 2020). There are also multiple instances of a disconnect between scientific advice and government policy, such as with the United Kingdom's Scientific Advisory Group for Emergencies (SAGE) (Gross 2020). Most academic scientists are ill-prepared for advisory roles, and thus providing effective communication tools is a promising route for improving the dialogue between science and politics (Gore, Nichols, and Lips 2020).

In the renewable energy space, there are existing international scientific conferences (i.e., Gordon Research Conference), but most are focused on fundamental science and networking within a scientific audience. Conferences including both scientists and policymakers, such as the Athens-based International Conference on Energy and Climate Change, are less common, even though both groups are critical to advances in renewable energy (Promitheas Network, n.d.). Moreover, there are no international spaces bridging these fields with cross-training opportunities. To provide this

platform, we propose establishing the International Renewable Energy Conference & Expo (IRECE), which will enhance collaboration between scientists and policymakers.

II. Policy recommendations

Our two policy recommendations address gaps in energy storage technology and science-policy communication. Furthermore, a rotating set of conference hosts and egalitarian membership for both initiatives will:

- 1) Reduce the influence of petrostates globally,
- 2) Provide support to basic science and applied research which can accelerate private sector growth in the application of renewable energy technologies, and
- 3) Improve communication and collaboration between policymakers and scientists globally in order to achieve NZ.

i. Recommendation 1: Launch WIES, the World Institute for Energy Storage

We recommend the Commission on Science and Technology for Development (CSTD) subsidiary body of the UN's ECOSOC (Economic and Social) council propose the establishment of an international basic science research center. This proposed research institute, WIES, is dedicated to the advancement, development, and global implementation of affordable and scalable energy storage solutions. WIES is modeled on other basic science establishments that foster science diplomacy, specifically CERN and SESAME (Lucibella 2014; Höne and Kurbalija 2018).

As a diplomatic initiative, WIES will foster collaborative relationships between countries through shared scientific endeavors. The governance structure of WIES will consist of analogs to CERN's Director-General, Government Council, and Scientific Policy Committee. Each member state of WIES will have two representatives (one political and one scientific) on the council. Having an international team composed of both government members and scientists will ensure that ongoing research is focused on supporting member countries' sustainable energy transition. We suggest the UN propose the establishment of WIES in 2023 with fifteen countries recruited by the opening scheduled in 2026.

Overcoming challenges

We anticipate securing and maintaining funding from member nations may pose a challenge. Member nations of WIES will be expected to supply a general budget for shared infrastructure proportional to their carbon footprint. Countries in financial need will be encouraged to apply for funds for projects through GEF (Global Environmental Facility) or may have a portion of their dues subsidized by other member nations. Constituents will also be permitted to use their own funding to conduct independent research projects using WIES equipment and encouraged to design experiments with other member states. To realize long term diplomatic goals, high- and middle-income member states will be partnered with lower-income members. Nations that partner will pay reduced dues.

One potential obstacle may be recruiting nations to join if they are already members of other international scientific institutions. However, WIES will tackle a new topic—energy storage—and unlike existing international research centers, WIES is focused on highly applied innovation. Discoveries from WIES will also provide the scientific advances needed for the private sector to invest in commercializing renewable energy. Taken together, this will increase independence from fossil fuels, bring WIES constituents closer to their NZ goals and nurture diplomatic ties between developing and developed nations.

Advantages

We anticipate that the private sector will benefit from research advances at WIES. A core tenant of WIES will be open-access research, such that any nation or member in the private sector can integrate energy storage solutions from WIES into its infrastructure irrespective of wealth and domestic capabilities. To encourage knowledge transfer and swift global implementation of emergent technology, WIES will adopt intellectual property and open-source licensing policies proven effective for previous international collaboration efforts (CERN 2022). Countries and industries will thus be able to use advanced energy storage technology freely and in accordance with the values of open-source science and the visions of WIES.

ii. Recommendation 2: Establish the International Renewable Energy Conference & Expo (IRECE)

We recommend UN Energy and the International Renewable Energy Agency (IRENA) establish the biennial IRECE for global scientists and policymakers in 2023, with the first conference to be held in 2025. We envision IRECE as a space for promoting effective communication on the paramount topic of renewable energy through cross-trainings and professional discussions in order to construct enduring diplomatic relations that will be pertinent to a successful global renewable energy transition.

The three-day professional conference will include: workshops to facilitate knowledge transfer and foster more productive crosstalk between scientists and policymakers (e.g., improving science communication, introduction to policy or academia, etc.); symposia and poster sessions wherein scientists and policymakers may present and discuss their applied work in a particular specialty (including future pilot energy storage projects from WIES); and networking events in order to encourage idea-sharing and collaboration. Researchers from participating countries will have access to micro-grants for developing pilot projects, with on-site exhibits. The final day will include roundtable discussions surrounding the themes chosen for the symposia/poster sessions.

Though professional conferences and global expos have been successful (e.g., the World Expo), there are no examples of the two being combined. A collaborative public/private energy technology and policy expo showcasing the latest energy-related advances worldwide to the public following the professional conference can bolster public support of the energy transition and market demand for clean energy technology. Finally, the increased public exposure of the renewable energy conference as well as the financial benefits of hosting an expo would encourage nation participation and engagement, as well as allow for funds for the micro-grants discussed above.

Overcoming challenges

Potential challenges of an international conference & expo include establishing initial traction, financing start-up costs, and avoiding the dominance of developed countries in an event meant to promote

global collaboration. We propose the UN and IRENA provide funding for the first three conferences using support from member states, including subsidy allowances for low-income countries. Expo ticket sales, vendor fees, and conference registration fees will additionally offset costs and profits can offset carbon footprints of attendees. Hosts may also expect a gain in terms of improved land value and infrastructure (BIE, n.d.), which may foster interest in hosting. Based on the World Expo and other conference examples, we expect to require <\$20M annually, which represents <0.5% of the UN budget (AGU 2021, 18; Better World Campaign 2022). Of this sum, approximately \$2M will go towards pilot project grants for member country teams.

To both decrease the financial burden on a single institution and promote international interest and collaboration, hosting and initial cost responsibilities will transition to a bidding system regulated by the Bureau International des Expositions (BIE) after initial six years, using a system similar to the World Expo (BIE, n.d.). We propose that the IRECE organizers apply for registration with the BIE after the first year to have the support, advice, oversight, and sponsor leads of experienced professionals and so that they may also regulate the bidding system for IRECE (BIE, n.d.).

Benefits for participating governments include better trained scientific advisors and policymakers better grounded in cutting edge science, both of whom should become better equipped to collaborate with each other. The conference will also offer a significant opportunity to showcase national innovation via pilot projects and share best practices for achieving NZ. Opportunities for networking internationally for individual attendees both within their field and with other professionals working in renewable energy should also accelerate interest. As an international conference & expo combination featuring cross-training and discussion workshops and focused on renewable energy, the IRECE presents a unique opportunity to build a renewable energy network bridging science and policy.

There is also an opportunity for the petrochemical industry to participate and engage with alternative energy sources and supplies for their businesses. A session will be focused on the industry transition

and identifying successful corporate strategies and technologies for the shift.

Advantages

The multiple advantages—public engagement, a focus on applied research, global collaborations with knowledge transfer to developing nations, the creation of a space for scientists and policymakers to engage, and the opportunity to forge enduring diplomatic ties in both renewable energy science and policy—make this an attractive proposal for a high-profile event. Founding IRECE will improve and encourage international crosstalk among professionals working in the renewable energy space, consequently promoting diplomatic cooperation in the renewable energy transition.

III. Conclusion and outlook

Progress towards achieving NZ is uneven and gaps remain between international climate policy and strategic implementation of renewable energy technologies. Today's status quo is untenable

(Tongia 2021; Masood and Tollefson 2021). Yet, the development and implementation of solutions to the NZ transition will require challenging traditional paradigms of energy diplomacy and deploying technical advances in a timely fashion. Energy storage technologies which can operate in a wide range of environmental and economic scenarios must be developed to expand renewable energy generation globally, and currently available renewable energy technologies must be made more efficient and widely available to ensure affordability.

The UN has an opportunity to expand diplomatic cooperation by encouraging communication and collaboration between policymakers and scientists and fostering advanced technological development. We believe that establishing WIES and IRECE would fulfill these ends. These proposals will facilitate collaboration between policymakers and scientists and international partnerships between developed and developing countries. Taken together, they can help democratize energy technology access during the sustainable energy transition.

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