An Acad Bras Cienc (2025) 97(Suppl. 4): e20250079 DOI 10.1590/0001-3765202520250079
Anais da Academia Brasileira de Ciências | *Annals of the Brazilian Academy of Sciences*
Printed ISSN 0001-3765 I Online ISSN 1678-2690
www.scielo.br/aabc | www.fb.com/aabcjournal

LETTER TO THE EDITOR

World Energy Transition: No Single Answers to Complex Challenges

FELIPE HUSADEL POYER, POLYANNA DA CONCEIÇÃO BISPO, FERNANDO R. MARTINS, ANDRÉ RODRIGUES GONÇALVES, RODRIGO SANTOS COSTA, MURILO DA COSTA RUV LEMES, CELSO H.L. SILVA-JUNIOR, CHRISTHIAN SANTANA CUNHA, ANDRÉ F.P. LUCENA & ENIO BUENO PEREIRA

As we grapple with the urgent issue of climate change, it is vital to recognize that energy has always been a paramount global concern. Converting energy from its primary source to its final use requires natural resources and can lead to significant environmental impacts (Murphy et al. 2021). Besides the environmental issues, a nation's energy policy is intrinsically connected to economic growth and social welfare, making it a complex and multidisciplinary task (Kahn et al. 2021).

Climate change is a global challenge that requires coordinated global action on mitigation and adaptation, including financial support to enable poor and emerging economies to respond appropriately and effectively (IRENA 2022). Brazil will have a crucial opportunity to contribute to the global energy transition agenda. The COP 30 in November 2025 provide a platform for just and inclusive discussions and decisions on the energy transition. The last COP finished with the commitment of US$300 billion dollars per year for climate finance. It is imperative to transform such commitment into tangible actions, considering environmental, social, and economic aspects while acknowledging that there is no one-size-fits-all solution. The energy strategies for Global North nations may not suit Global South ones well.

The ongoing energy transition to renewable technologies is not just about changing the energy sources and carriers but also about the infrastructure adequacy required to make this new energy era possible (IRENA 2022). Infrastructure transitions are high-cost actions, and not all countries have the financial capacity or political will to undertake them at the right time (Kahn et al. 2021, IRENA 2022).

In addition to economic differences, countries have unique environmental characteristics that can provide different energy solutions for their needs. Technological and geopolitical alternatives must be made sovereignly by each nation, yet must be consistent with the global imperative for a greener future. A feasible and realistic energy transition must contemplate all prospects for energy production, distribution and consumption, considering that every energy solution entails trade-offs requiring evaluation within the context of regional realities.

Nevertheless, a multinational coordinated effort is required to turn last year's pledges into concrete global policies for a sustainable world. This is also an opportunity to reduce inequality between nations and build regional capacity to face climate change challenges, contributing to United Nations Sustainable Development Goals (SDG) advances (Hampl 2022). The financial support discussed at the last COP is a remarkable initiative that must be implemented fairly and with global governance. It is vital that this support is financially attractive, as grants or loans below market rate, and does not become another influence and dependency enforcement between nations.

This strategy benefits all, as the Global North could pursue its Nationally Determined Contributions (NDC) achievement by importing green energy and green certified products from the Global South, reducing its reliance on fossil fuels, and promoting Global South development. Our chances as a species increase when we think globally and act locally, considering all available alternatives and their proper trade-offs. There is no single answer to complex challenges.

Acknowledgments

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001 and by the Programa Institucional de Internacionalização – CAPES - PrInt.
The authors would also like to acknowledge the Prof. Martin Evans and the School of Environment, Education and Development (SEED), for supporting Poyer's research visit to the University of Manchester.

REFERENCES

HAMPL N. 2022. Equitable energy transition in Latin America and the Caribbean: Reducing inequity by building capacity. Renew Sust Energy Tr 2: https://doi.org/10.1016/j.rset.2022.100035.

IRENA. 2022. World energy transitions outlook 2022. World Energy Transitions, p. 1–54. https://www.irena.org/Digital-Report/World-Energy-Transitions-Outlook-2022#page-0.

KHAN I, HOU F, IRFAN M, ZAKARI A & LE HP 2021. Does energy trilemma a driver of economic growth? The roles of energy use, population growth, and financial development. Renew Sustain Energy Rev 146: 111157. https://doi.org/10.1016/j.rser.2021.111157.

MURPHY TW, MURPHY DJ, LOVE TF, LEHEW MLA & MCCALL BJ. 2021. Modernity is incompatible with planetary limits: Developing a PLAN for the future. Energy Res Soc Sci 81: 102239. https://doi.org/10.1016/j.erss.2021.102239.

How to cite
POYER FH, BISPO PC, MARTINS FR, GONÇALVES AR, COSTA RS, LEMES MCV, SILVA-JUNIOR CHL, CUNHA CS, LUCENA AFP & PEREIRA EB. 2025. World Energy Transition: No Single Answers to Complex Challenges. An Acad Bras Cienc 97: e20250079. DOI 10.1590/0001-3765202520250079.

Manuscript received on January 20, 2025;
accepted for publication on August 6, 2025

FELIPE HUSADEL POYER[1,2*]
https://orcid.org/0000-0001-5951-272X

POLYANNA DA CONCEIÇÃO BISPO[2*]
https://orcid.org/0000-0003-0247-8449

FERNANDO R. MARTINS[3]
https://orcid.org/0000-0002-7618-4462

ANDRÉ RODRIGUES GONÇALVES[1]
https://orcid.org/0000-0002-9430-1685

RODRIGO SANTOS COSTA[1]
https://orcid.org/0000-0002-9544-4610

MURILO DA COSTA RUV LEMES[1]
https://orcid.org/0000-0002-8074-2332

CELSO H.L. SILVA-JUNIOR[4]
https://orcid.org/0000-0002-1052-5551

CHRISTHIAN SANTANA CUNHA[5]
https://orcid.org/0000-0002-0755-6760

ANDRÉ F.P. LUCENA[6]
https://orcid.org/0000-0003-1976-6607

ENIO BUENO PEREIRA[1]
https://orcid.org/0000-0002-5095-0085

[1]National Institute for Space Research (INPE), Division of Impacts, Adaptation and Vulnerabilities (DIIAV), Avenida dos Astronautas, 1758, 12227-010 São José dos Campos, SP, Brazil

[2]University of Manchester, Department of Geography, School of Environment, Education and Development: Oxford Road, M13 9PL, Manchester, U.K.

[3]Federal University of São Paulo (UNIFESP), Institute of Marine Science (IMar), Rua Carvalho de Mendonça, 144, 11030-100 Santos, SP, Brazil

[4]Amazon Environmental Research Institute (IPAM), SCLN 211, Bloco B, Sala 201, Asa Norte, 70863-520 Brasília, DF, Brazil

[5]Federal University of Rio Grande do Sul (UFRGS), Avenida Paulo Gama, 110, 90046-060, Porto Alegre, RS, Brazil

[6]Federal University of Rio de Janeiro (UFRJ), Center for Energy and Environmental Economics (CENERGIA), Energy Planning Program (PPE), COPPE, Cidade Universitária, Centro de Tecnologia, Ilha do Fundão, 21941-972 Rio de Janeiro, RJ, Brazil

**These authors contributed equally*

Correspondence to: **Felipe Husadel Poyer**
E-mail: felipe.poyer@inpe.br

CC BY