Gulf Research Centre Cambridge

Knowledge for All

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Workshop No. 3

Human Infrastructure of the Energy Transition: Research and Education for Sustainable Energy in the Gulf

1. **Directors**

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2. **Abstract**

The GCC states have committed to ambitious renewable energy, efficiency, and emissions-reduction targets. Whether these are met depends as much on human capital as on investment. This workshop examines how research systems, universities, technical institutions, and schools across the Gulf region are preparing the people a sustainable energy transition needs: researchers, engineers, technicians, regulators, standards experts, and informed citizens. The workshop will invite comparative, policy-oriented papers on research governance, curriculum reform, technical and vocational training, workforce nationalization, women in energy careers, international research partnerships, the role of data and artificial intelligence (AI) in energy research and education, and public energy literacy. The workshop aims to identify which institutional arrangements deliver usable research and job-ready graduates, and where the gaps lie. It will produce an edited volume and policy recommendations for Gulf education, energy and labor market institutions.

3. **Context**

Most GCC countries have announced long-term net-zero or emissions-reduction targets. Utility-scale solar, energy efficiency programs and sustainable energy plans now feature in national strategies. Policy debate and scholarship, however, have concentrated on technology, finance and geopolitics. Far less attention has gone to the human infrastructure of the transition, such as the research capacity, education and training systems, institutional expertise and public understanding on which every national strategy depends.

The literature shows that this human infrastructure shapes the pace and success of energy transitions. Education, skills and managerial capacity drive the adoption of clean energy technologies, and human capital development works together with digitalization to accelerate clean energy transitions. Research and knowledge infrastructures are foundational to developing and deploying new energy solutions, while weak institutions and limited capacity remain major barriers in developing economies. Public engagement and readiness are also essential, yet often neglected in policy, and international cooperation plays a growing role in building transition capacity.

Very little existing literature examines the Gulf. The region combines ambitious transition targets with specific human capital challenges: creating skilled employment for young nationals, increasing women's participation in STEM and energy careers, and building knowledge economies beyond hydrocarbons. Experience across the region suggests that energy projects are more often slowed by coordination and capability gaps between ministries, utilities, regulators and education providers than by technical constraints. The growing role of data and AI adds a further dimension, as energy research increasingly relies on data-driven methods and energy programs must develop new data and AI skills. Gulf countries differ in how they fund research, in the balance between universities and technical colleges, in researchers' access to energy data, and in their reliance on international partnerships. Iraq, Iran and Yemen add contrasting cases of energy-dependent economies facing capacity constraints under very different conditions. By bringing these cases together, the workshop addresses a clear gap in both Gulf studies and the broader energy transition literature.

4. Workshop Focus/Objectives

The workshop focuses on how research systems, universities, technical institutions, and schools across the Gulf are preparing people for sustainable energy transition needs: researchers, engineers, technicians, regulators, standards experts, and informed citizens. It treats research and education as the core of the transition's human infrastructure and asks which institutional arrangements deliver usable research and job-ready graduates, where gaps lie, and what policies could close them. Within this focus, the workshop also considers how data and AI are changing the way sustainable energy is researched and taught.

The workshop is comparative and policy-oriented. It invites empirically grounded papers from education, economics, political science, sociology, public policy, and energy studies, and from practitioners in government, utilities and regulatory bodies. Comparative papers covering more than one Gulf country, and papers using original data, are especially encouraged.

The objectives of the workshop are as follows:

1- Compare sustainable energy research and education capacity across Gulf states
2- Assess how education and training systems are aligned with national energy transition targets and labor market needs
3- Evaluate the role of international research and education partnerships, particularly EU-Gulf and UK-Gulf cooperation, in building local capability
4- Examine how data and AI are being used in, and are changing, sustainable energy research and education in the region
5- Analyze the youth, nationalization and gender dimensions of the emerging energy workforce
6- Examine public energy literacy and climate education, and their implications for demand-side policy
7- Generate evidence-based policy options for ministries, universities, regulators, industry, and funders.

5. Paper Focus/Topics

• Governance, funding and output of sustainable energy research in Gulf universities and research centers
• Curriculum reform, new degree programs, and interdisciplinary education in renewable energy, efficiency, and sustainability
• Technical and vocational education, micro-credentials and certification for solar, grid, efficiency and hydrogen occupations
• Energy transition employment and the nationalization of Gulf labor markets
• Women in energy research, engineering, and energy sector leadership
• EU-Gulf and other international research partnerships in sustainable energy
• How research informs energy strategy, regulation, and international standards participation
• The role of data and AI in sustainable energy research and education, including access to energy data, data-driven research methods, data and AI skills in curricula, and AI in teaching and assessment
• Energy literacy, climate education in schools, and public attitudes to energy and cooling use
• National energy companies, utilities and industry as education and training actors

• Comparative lessons across Gulf countries and from other hydrocarbon-dependent economies

6. Publication Plans

The workshop directors aim to publish all suitable papers, in the following order of preference. (i) Edited volume: an edited volume, co-edited by the two directors, with an established academic publisher that has published previous GRM volumes, such as Gerlach Press or Springer. The book would be organized in four thematic parts: research systems and the science-policy interface; higher education, curriculum, and data and AI in research and teaching; skills, technical and vocational education and training (TVET), and the energy workforce; and international partnerships, public energy literacy and comparative lessons. It would include the directors' introductory and concluding chapters.

(ii) Special issue: if an edited volume is not feasible, a special issue of a peer-reviewed journal at the intersection of energy and society, such as Energy Research & Social Science or Energy Policy.

(iii) Journal articles: papers that cannot be included in the joint publication will be supported toward individual publication in peer-reviewed journals matching their focus, such as Energy Strategy Reviews, Utilities Policy, the International Journal of Sustainability in Higher Education or the European Journal of Engineering Education.

(iv) GRC papers: any remaining publishable papers will be published as GRC papers.

7. References

Ahmed, M., E. Araral, and M. A. Khan. 2025. "Barriers to Just Energy Transition: Institutional and Infrastructure Challenges in Developing Countries." Sustainable Futures.

Cheng, A. W. J., and H. F. Lee. 2022. "Energy Transition towards Sustainable Development: Perspective of Individuals' Engagement amid Transition Process." Sustainability.

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Li, M., L. Shi, and X. Fulati. 2025. "The Role of Managerial Capacity and Education and Skills in Driving the Energy Transition." Sustainability.

Ullah, S., A. Khan, and W. Suli. 2026. "Twin Transition: The Role of Human Capital Development and Digitalization on Clean Energy Transition." Journal of Environmental Management.

Wolff, C. F., and I. Santourian. 2025. "The Global Dimension of the Energy Transition: Contributions from PTB's International Cooperation." Technisches Messen.

8. **Workshop Directors**

Dr. Hanan Albuflasa is Assistant Professor of Renewable Energy in the Department of Physics, University of Bahrain. Her work links academic research, international standards, and national energy policy. She was Principal Investigator for the University of Bahrain in the EU-GCC DESOLINATION project (2021–2026). She represents Bahrain on the IEC TC 82 (solar photovoltaic) and TC 88 (wind energy) international standards committees and contributed to Bahrain's Third National Communication on greenhouse gas emissions. Her policy experience includes advising Bahrain's Sustainable Energy Unit (2016-2018) and secondment as Acting Director General of Energy Efficiency at the Ministry of Electricity and Water Affairs (2023–2024). She teaches both undergraduate and postgraduate courses on renewable energy and sustainability and has supervised MSc and PhD students. She has been a faculty member at the University of Bahrain since 2002 and has served as rotating Chair of the Department of Physics. Her current research covers household energy consumption, hydrogen strategy and public awareness of air pollution in Bahrain. She is a full member of the Organization for Women in Science for the Developing World (OWSD). She previously participated in GRM 2014, contributing the chapter "The Potential Role of the Gulf Countries in Re-Shaping the Global Renewable Energy Landscape" to The Changing Energy Landscape in the Gulf: Strategic Implications (Gerlach Press, 2015).

Prof. Sheryl Williams is Professor of Engineering Education Technology in the Wolfson School of Mechanical, Electrical and Manufacturing Engineering at Loughborough University, United Kingdom. An electrical engineer and internationally recognized researcher and teaching expert, she has spent more than two decades harnessing and developing technology to create high-quality, inclusive learning for students across disciplines and around the world. Beginning as a solar energy PhD researcher in Loughborough's Centre for Renewable Energy Systems Technology (CREST), she developed remote laboratories that enabled students to carry out photovoltaic experiments from anywhere in the world in a cost-, time- and resource-effective way. She has established employability programs within taught courses and led course development to keep programs relevant to employer needs, and has wide experience in leading diverse teams of academics, students, administrators, and employers. She is Director of International Relations and Partnerships with the remit of engaging different international stakeholders in the activities of the Wolfson School. In her previous role as Director of Studies for postgraduate taught programs across the School and Taught Programmes and Skills Lead for the EnerHy Centre for Doctoral Training she leads the skills development and career readiness of students. She is also active in outreach that encourages young

people from all backgrounds to choose engineering, and in 2025, she was one of three UK finalists for Outstanding Woman in STEM at the PRECIOUS Awards.