

مركز البحرين للدراسات الاستراتيجية والدولية والطاقة
Bahrain Center for Strategic, International and Energy Studies



Industry-Academia Collaboration Towards Advancing the Energy Transition

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Abstract

This report provides an overview of a roundtable discussion held by the Bahrain Center for Strategic, International and Energy Studies (Derasat) on May 2nd, 2024, to explore the collaborative potential between industry and academia in advancing the energy transition. The discussion, which connected key stakeholders, researchers, academics, and industry professionals, revealed several critical insights, such as the difficulty of meeting sustainability goals due to conflicting global objectives and technological constraints; the urgent need for the oil and gas sector to enhance emission control; unconventional resources; and the necessity of a balanced approach that incorporates both renewable and fossil fuels. Key recommendations from the discussion included: fostering cooperation between fossil fuel and sustainable energy sectors; providing robust policy support for decarbonization; and enhancing systematic collaboration between academia and industry to drive innovation.

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Executive Summary

On May 2nd, 2024, Derasat Center assembled a group of key stakeholders in the energy sector in the Kingdom of Bahrain alongside a US-based energy expert to discuss the role of collaboration between industry and academia in advancing the energy transition. The main findings and outcomes of the roundtable meeting were as follows:

1. It emphasized challenges in achieving sustainability goals due to contradicting global objectives and technological limitations.
2. It recognized the need for greater emission control efforts by the oil and gas industry, including methane leak reduction, highlighted financial barriers to adopting cleaner technologies, and the role of policy making in incentivizing decarbonization.
3. It acknowledged the continued reliance on fossil fuels while intensifying efforts to mitigate environmental impact.
4. It stressed the importance of the balanced approach considering both renewable and fossil fuels.
5. It identified challenges such as economic barriers, reliability issues with renewables, and political reluctance to internalize sustainable energy costs.
6. It emphasized the importance of unconventional resources in meeting energy demand and discussed corresponding water management challenges.
7. It advocated for cooperation between sustainability and oil/gas sectors to address environmental concerns.
8. It highlighted the significance of collaborative frameworks between academia and industry for innovation and progress.
9. It identified challenges, such as lack of communication channels between local universities and industries, and the misalignment between educational priorities and industry demands.
10. It recommended establishing systematic communication channels, promoting collaboration, and focusing on solving local problems with local expertise.

Based on these findings, the discussion resulted in the following recommendations:

1. Enhancing efforts on emission control in the oil and gas industry and exploring alternative resources.
2. Promoting effective collaboration between fossil fuel and sustainable energy industries.
3. Addressing water management challenges in the energy sector.
4. Providing policy support for decarbonization initiatives.
5. Facilitating industry-academia collaboration across the various energy transition domains.

1. Introduction

Sustainable energy transitions have rapidly risen to the top of national agendas globally, driven by growing climate threats and increased interests in achieving holistic security. Energy is considered sustainable if it meets current requirements without compromising future generations' abilities to fulfil their own needs. Recognizing the intertwined environmental, economic, and social impacts, global efforts have been directed to minimize adverse effects resulting from greenhouse gas emissions, air pollution, energy poverty, and toxic waste. This includes commitments made by more than 140 countries, including the biggest global polluters, to achieve net zero emissions^[1]. Debates are still active on the sufficiency of renewable energy to achieve decarbonization while maintaining economic prosperity and growth. Arguments are consistently made on the role of the fossil fuel industry in achieving net zero targets, with a wide consensus on the importance of emission reduction and elimination. This highlights the need for effective collaboration between key industry players and academia to generate pragmatic solutions that balance environmental concerns with socioeconomic development.

The Kingdom of Bahrain has a mature oil and gas industry, driving the country's growth since its initial discovery in 1932^[2]. While Bahrain's Economic Vision 2030 prioritize diversification away from oil and gas, the sector remains a vital part of the country's energy mix. The Kingdom also continued its efforts in exploring on-shore and off-shore resources, discovering shale oil reservoirs in 2018 and two unconventional gas reservoirs in 2022^[3,4]. Widely regarded as Bahrain's main pathway towards energy security and economic well-being, fossil fuel discoveries are met with concerns regarding the industry's water usage and emission control. This creates an opportunity to intensify national research endeavors that aim to effectively solve local challenges. The significance of the latter is further demonstrated by the growing need to address tradeoffs between sustainable energy and fossil fuel usage. Bahrain, with its unique set of challenges and capabilities, requires tailored solutions framed by comprehensive knowledge of the Kingdom's energy landscape. In essence, this necessitates effective collaboration between key industry players and local academic institutions to align research outputs with national priorities and redirect resources towards optimal usage.

The Bahrain Center for Strategic, International and Energy Studies (Derasat) organized a closed roundtable to examine the role of industry-academia collaborations in advancing energy transitions. Aiming to initiate a stimulating discussion on Bahrain's progress in energy transition, the roundtable connected several stakeholders, including industry specialists, academics, researchers, and an international expert. The discussion focused on identifying and evaluating key opportunities and challenges in the energy sector, including research and development (R&D). By facilitating an inclusive conversation, the roundtable targeted the extraction of insightful observations and practical recommendations, as summarized in this report.

2. Roundtable Format

To examine the role of industry-academia collaboration in advancing Bahrain's energy transition, the roundtable focused on three core objectives: stakeholder engagement, knowledge exchange, and challenge identification. The first objective targeted convening stakeholders, including experts, academics, and industry professionals, to discuss and assess the current state of research in Bahrain's energy sector, aiming to enable informed recommendations. Second, the roundtable aimed to foster effective collaboration and knowledge exchange with international experts to generate actionable insights that accelerate Bahrain's energy transformation. This is further reinforced by the third objective, which focused on identifying barriers and challenges hindering progress towards effective industry-academia collaboration, while highlighting prospective solutions, best practices, and successful case studies.

To achieve the desired objectives, a closed roundtable format was adopted to ensure an interactive discussion environment that allows participants to engage freely. Participants included key stakeholders from various backgrounds who have contributed significantly to shaping Bahrain's energy landscape. This involved a US-based energy expert, local energy experts, industry professionals, policymakers, researchers, and academics. The roundtable discussions covered a wide range of topics such as energy transitions, sustainable energy, net-zero targets, and unconventional resources.

3. Participants

To ensure the representation of diverse perspectives, a total of ten participants were invited to take part in the roundtable, as follows:

- An international professor specializing in energy.
- Two local professors specializing in energy.
- Two local professionals formerly involved in energy policymaking.
- A local researcher in energy and sustainability.
- Four industry professionals representing key players in Bahrain's energy sector.

4. Findings

The roundtable covered four main discussion topics, prompted by targeted questions, as follows:

4.1 Sustainability

The roundtable began by delving into sustainability challenges and the global commitment to achieving net-zero emissions. Initial remarks indicated that some of the global goals are contradictory and difficult to achieve, as modern technologies are not yet able to produce affordable energy and be climate sensitive simultaneously. The discussion then veered onto the role of the oil and gas industry in enhancing emission control efforts, specifically with regards to the elimination of methane leaks. There was a consensus on the need for greater efforts to be undertaken by the industry on this matter. Notably, around 50 major oil companies have pledged to reduce their carbon emissions to net zero by 2050 and curb methane emissions to near-zero by 2030, as stated during the proceedings of the 2023 United Nations Climate Change Conference (COP 28)^[5]. However, the need to adopt improved technologies in the oil and gas industry, such as enhancing efficiency or electrifying equipment, must be stressed. The discussion highlighted that carbon dioxide (CO₂) emissions cannot be eliminated during the burning of fossil fuels, which will continue to happen as long as the world needs energy. The oil and gas industry contributes to advancing Carbon Capture, Utilization, and Storage (CCUS) technologies. However, these

technologies are impeded by financial challenges as there are minimum incentives for investment. This highlights the role of policymaking and regulatory procedures in encouraging companies to invest in decarbonization. For example, the USA's Inflation Reduction Act of 2022 set more than 20 tax incentives for clean energy and manufacturing, aiming to strengthen the country's energy security and tackle climate change^[6]. The significance of the latter was particularly reinforced by the strong conviction across the roundtable discussion that it is impossible to phase out fossil fuels completely in the next thirty years, especially as new wealth is discovered across developing countries. Experts concluded that mining for oil and gas will continue, even after fuel burning stops, due to the wealth of resources extracted from these reservoirs. Climate changes occur periodically; therefore, it is the responsibility of civilizations to adapt and mitigate their harmful impacts. This is where the influence of policies is apparent, seeking to nudge people towards eco-friendly actions and reorienting their priorities.

Supplementing the discussion, it was widely agreed that the dangers of environmental pollution are widely understood, including the impact on freshwater resources and air quality. However, the pragmatic solution is to address the impacts of fossil fuels as opposed to completely cutting them out. As the world is currently not ready to depend on fossil alternatives, the ideal solution involves forging an effective partnership between the fossil fuel industry and the sustainable energy industry. This is crucial to secure realistic targets for the energy transition, as all alternative energy sources today are still empowered by the fossil fuel industry.

The role of CO₂ as a key driver of climate change was then discussed, with opposing arguments raised regarding the gas's adverse impacts and its global exploitation as a political stunt. At a high-level, there was a consensus on the evidence provided by climate scientists on the impact of anthropogenic CO₂ emissions on global warming, despite uncertainties tied to climate models. The predominant notion was that arguing about CO₂'s real role dilutes the discussion and diverts it away from the required solutions. However, accurately framing the problem within its scientific context is integral to defining correct solutions. This drew remarks across the roundtable on the dwarfed harms of CO₂ compared to other anthropogenic emissions such as nitrogen oxides (NO_x) and sulfur oxides (SO_x). Supporting this concept, the discussion highlighted the need to maintain CO₂ concentrations within a certain threshold for natural prosperity, as indicated by historical data (i.e., the ice age). Therefore, there is an urgent need

to reduce pollution and widen the scientific discussion beyond political constraints. On the other hand, opposing perspectives supplemented the discussion by emphasizing the direct impact of CO₂ on public health and the environment, as proven by several scientific studies^[7,8]. This perspective holds that targeting a net-zero future does not equate to waging war on fossil fuels, but rather synchronizing their usage with sustainable principles and renewable sources. For example, the Kingdom of Saudi Arabia's Circular Carbon Economy National Program focuses on fostering sustainable development through circular carbon principles to reduce emissions and enhance resource efficiency^[9]. Moreover, recent advancements in research and development, such as the conversion of CO₂ to diamonds and the invention of carbon batteries, prove that captured CO₂ can be utilized in a variety of ways. This drives the need to comprehensively think of challenges, which involves formulating strategies that align with environmental priorities and economic growth. Research and development play a key role in this area, particularly in creating solutions tailored to the unique needs of the Kingdom of Bahrain, as opposed to importing them. Several challenges facing Bahrain's energy sector require local scientific attention, including water production and management, CO₂ utilization, and bioprocessing.

4.2 Energy Transition

The second item covered in the discussion revolved around energy transitions and global prospects. Energy transitions have historically been cumulative by adding more sources to existing ones. The additive perspective allows for a synergistic relationship between renewables and fossil fuels, while the substitutive perspective is destructive. Additionally, the discussion involved challenging the word "transition", indicating that it implies a short-term action, which is unrealistic. Achieving a balance between the usage of renewables and fossil fuels depends on differing capabilities from one country to another. This necessitates the investigation of different types of energy to optimally redirect investments. In Bahrain, for example, there has been growing interest in adopting renewable energy solutions over the past decade, since the establishment of the Sustainable Energy Unit (SEU) in 2014. However, the Kingdom's energy-intensive needs cannot be fulfilled solely by renewable sources. This is further compounded by challenges, such as the need to develop a more mature legal framework for renewables and energy efficiency, the need for more detailed targets, and market skepticism on the reliability of

renewables. Economic challenges hinder the growth of renewables, which face unmatched competition from subsidized fossil fuels, irrespective of their environmental costs.

There is a significance to having several alternative forms of energy, noting that clean energy is not restricted to solar and wind production. Other options include geothermal energy, which requires ideal geological conditions for its success, and nuclear energy, which can pose some safety risks. Nuclear technologies, such as Small Modular Reactors (SMRs), can provide a pathway to achieve the net-zero emissions target, especially in the GCC region, by 2060. Solar energy is also effective in the region, alongside other promising technologies such as hydrogen. However, for renewables to be effective, there must be a proper integration into the energy mix, without compromising on economic growth. A key challenge with renewables is energy storage, which reduces their reliability in energy-intensive sectors.

The discussion drew further remarks on the political aspect of the energy transition. While there are some penalization policies enacted globally, such as carbon taxes, regulatory instruments usually backfire as populations find that efficiency is not as costly as convenience. Therefore, it is important to set clear timelines and detailed targets during policymaking, which may also involve social practices to promote certain public behaviors.

4.3 Unconventional Resources

Unconventional resources are energy resources found in reserves where hydrocarbons are tightly confined inside rock layers and can only be extracted using adapted technologies, such as horizontal drilling and hydraulic fracturing. With growing energy demands, unconventional gas resources are becoming increasingly important as a vehicle for successful energy transitions. North America is widely regarded as a pioneering region in this domain, witnessing significant growth in the production of unconventional fossil fuels over the past two decades^[10]. However, one of the biggest challenges faced in the US during the production of unconventional resources was water management. This included a high demand for freshwater, disposal of fracturing fluid, and adverse environmental impacts. Discussing the latter, the example of the southern US states was cited, where production processes of unconventional fossil fuels resulted in a five-inch sink in the ground in New Mexico and a similar rise in

the ground in Texas due to water injections. These negative environmental impacts constitute a major impediment for the advancement of unconventional operations, which can promote their stoppage altogether. On such a basis, it can be concluded that water management is a key commonality that can bridge the gap between the sustainability industry and the oil and gas industry. Effective cooperation between these two domains can propel innovative problem-solving, which can eventually lead to finding cost-effective methods to produce freshwater and manage used water. The discussion also emphasized the responsibility of the oil and gas sector to increase its efficiency by reducing consumption and waste, consequently enhancing its sustainability.

Examining the case of Bahrain, the discussion highlighted that the Kingdom faces similar water management challenges in oil and gas production. Experts on the roundtable estimated that Bahrain currently produces around eight barrels per day of associated water, which is mainly treated and reused. However, for the Kingdom to exploit its unconventional resources, there must be a thorough examination of existing resources and water injection processes. The discussion highlighted previous studies, focused on the case of Bahrain, that proved the feasibility of using seawater for fracking. This suggests that the country is posed to leverage its available infrastructure and the abundant availability of seawater to fully exploit its newly found resources. Nevertheless, effective management of associated water still presents a key challenge that must be addressed. This point drew further remarks from roundtable participants on the efficiency of using seawater for fracking. Concurring on the importance of considering varied geological topographies in each region, opinions varied on the possibility of further problems rearing in the long-term due to the usage of seawater. These problems include introduction or exacerbation of scaling, corrosion, and hindrance of desired fluid performance. Consequently, experts around the table indicated that the production of freshwater, in a highly water-stressed region, is a complex process that requires further assessment. As the region's economies and populations are growing, the demand for freshwater is rising. This necessitates the formulation of strategies to leverage and invest in various sources of water production, including water recycling, treated sewage water, and advanced desalination technologies.

4.4 Industry-Academia Collaboration

The final discussion topic covered the mechanisms required to foster the relationship between academia and industry to facilitate a smooth energy transition. Attracting significant attention among participants, there was a consensus on the importance of establishing collaborative frameworks to maximize innovation and drive progress. Academic institutions have a particular responsibility towards committing to combat climate change, which is only viable through effective partnerships and exposure to key industry players. Such interdisciplinary partnerships create opportunities to generate valuable research. In Bahrain, the discussion highlighted that the required infrastructure is mainly available, and the human capital is sufficiently capable. However, there is a need to join relevant organizations in developing shared research areas, both theoretical and technical. In essence, the challenge remains a matter of structuring, which can be facilitated by the Kingdom's most prominent academic and research institutions, such as Derasat Center and the University of Bahrain. The desirability to create an official communication mechanism between local universities and key industry players was consistently stressed throughout the discussion. Industry professionals highlighted that a wide array of research opportunities exist of which is the establishment of a high-level systematic communication channel between local academic institutions and industries. On this note, remarks were presented on the need to equally promote such collaborations within industrial and academic domains, indicating that industrial companies often prefer referring to international entities (e.g., universities, consultancies, etc.) due to the strengths of their brands in research output. This widens the gap between local organizations and deprives the industry of adopting indigenous tailored research solutions. Research and development are needed for continuous improvement, and this requires advocacy on a national level. The research ecosystem needs to evolve to better foster various opportunities and secure the endorsement of relevant government entities to provide further support to the national research output.

Furthermore, the discussion also addressed existing collaborative pathways between universities and the industry, such as study groups, internships, and R&D centers. National educational institutions face challenges in attaining internships for their students, with response rates across various industries falling short of universities' aspirations. This drew remarks on the need to establish a methodical

communication system that allows companies to identify opportunities for efficient training programs and internships. Moreover, there is a lack of financing opportunities for initiatives within these institutions, which has adverse impacts on the main suppliers of the local workforce. This signals the requirement to align industrial and academic directions to reflect positively on Bahrain's unique socioeconomic conditions. The relationship between both sectors has to be complementary, as manifested through industry-sponsored R&D centers that are responsive to market/industry trends. On this note, the discussion delved into the misalignment between the local educational system's priorities and its industrial/labor market counterparts. This hinders the efficacy of research outputs, which become confined to theoretical concepts and imported solutions. On the other hand, some experts opined that universities are not responsible for job training or labor market preparation. Instead, educational institutes must focus on teaching fundamentals and problem-solving skills to maintain their progress, without the need to respond to the industry's changing demands. This perspective emphasizes the role of educational institutions in investigating collaboration methods with their industrial counterparts on research subjects. Citing US-based educational entities as an example, the discussion showcased the importance of consultations between industry professionals and academic faculties to identify problems and solutions. These best practices include requiring faculty members to approach different industry leaders, create industry-applicable research proposals, and conduct summer work in the relevant industry. A key element to the success of these best practices is the focus on solving local problems through local strengths, capabilities, and knowledge. This supplements initial remarks made on the desirability of adopting locally grown solutions and decreasing the reliance on imported solutions. The discussion concluded with a majority consensus on the importance of effective R&D and the subsequent investments in contributing to the progressive success of countries and institutions.

5. Final Recommendations

The dynamics of this roundtable allowed for the extraction of several recommendations, as follows: -

Recommendation 1 - Enhancing efforts on emission control in the oil and gas industry:

- Encourage the oil and gas industry to intensify efforts to reduce methane leaks and carbon emissions.
- Incentivize the adoption of improved technologies and strategies in the industry, such as enhancing efficiency and electrifying equipment.

Recommendation 2 - Promoting collaboration between fossil fuel and sustainable energy industries:

- Foster partnerships between the fossil fuel industry and the sustainable energy industry to achieve realistic targets for the energy transition.
- Invest in greenifying the fossil fuel industry, such that it complements alternative energy sources.
- Explore diverse energy sources to meet growing demands.

Recommendation 3 - Addressing water management challenges:

- Focus on developing solutions for effective water management in oil and gas production.
- Investigate innovative solutions to produce freshwater and the wider utilization of seawater.

Recommendation 4 - Providing policy support for decarbonization:

- Implement policies and regulatory procedures that incentivize companies to invest in decarbonization efforts.

Recommendation 5 - Facilitating industry-academia collaboration:

- Establish collaborative frameworks between academia and industry to drive innovation and progress in energy transition.
- Develop official communication mechanisms between local universities and key industrial players to promote research partnerships and address skill gaps in the workforce.
- Align educational priorities with industry needs to ensure research outputs are relevant and applicable to local conditions.
- Encourage industry-sponsored R&D initiatives that address local challenges through locally driven solutions.

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