تحت رعاية صاحب السمو الشيخ محمد بن زايد آل نهيان، رئيس دولة الإمارات العربية المتحدة

Under The Patronage of H.H. Sheikh Mohamed Bin Zayed Al Nahyan, President Of The United Arab Emirates

ADIPEC أديبك
نادي الشرق الأوسط للطاقة
Middle East Energy Club

Host
أدنوك ADNOC

ADIPEC Leadership Roundtable

2023 Output summary

Decarbonising. Faster. Together.

UAE CLIMATE TECH: Leveraging technology and partnerships to accelerate the journey to net-zero

Host Partner	Knowledge Partner
UAE CLIMATE TECH TRANSFORM. DECARBONIZE. FUTURE PROOF.	BloombergNEF

ADIPEC, brought to you by:
dmg::events

ADIPEC Leadership Roundtables

Defining the global energy future

The ADIPEC Leadership Roundtables play a pivotal role in the ADIPEC Strategic Conference programme. These sessions are held at the prestigious Middle East Energy Club (MEEC) and bring together ministers, top industry executives and policymakers from over 100 countries to engage in meaningful discussions and seek viable solutions to today's most pressing climate and energy challenges.

As part of an exclusive network of dynamic global executives, participants in the ADIPEC Leadership Roundtables are at the forefront of the energy sector, driving change with their insights and solution-oriented outcomes.

These roundtable sessions foster open and impactful conversations among influential decision-makers who are shaping the responsible energy industry's future and implementing innovative business strategies to create a cleaner and more secure energy landscape.

With a limited attendance of 30 delegates per session, each 90-minute roundtable is expertly facilitated by an experienced moderator and hosted by a thought leader in the industry. This format ensures highly interactive discussions and provides fresh, objective perspectives.

Foreword

With the COP28 global stocktake imminent, all of us working in, and connected to, the energy sector have a continuing crucial role to play in ensuring that we provide the world with energy that is secure, sustainable, and affordable.

Across the board, work is being done to turn challenges into opportunities in order to protect the environment for future generations while ensuring the provision of secure, affordable, decarbonised energy remains an essential focus.

Global powerhouse gatherings such as ADIPEC and UAE CLIMATE TECH, held in May 2023, are serving to accelerate the development and deployment of transformative climate technologies by fostering actionable debate and collaboration.

Technology, paired with collective innovation and action, will play a critical role in unlocking the energy trilemma we are facing with the forging of fresh partnerships critical to accelerate deployment of the right technologies that will drive meaningful global change and impact.

Hosted by:
Sophie Hildebrand
Chief Technology Officer
ADNOC

UAE CLIMATE TECH: Leveraging technology and partnerships to accelerate the journey to net-zero

In the context of 'Decarbonising. Faster. Together', the leveraging of technology and partnerships to accelerate the journey to net-zero represents a duality of challenge and opportunity.

In 2022, cumulative global investment in clean tech surpassed US$1 trillion but existing technologies also have a role to play in supporting the value chain, while partnerships play a critical role from both an innovation and delivery perspective.

The sheer scale of the transformation required across the energy system mandates a need to look at partnering in new and different ways as investments scale up and new pathways to achieve net-zero from an energy and emissions perspective are explored.

Is the US$1 trillion enough to take us through to 2050? Certainly not. Analysis conducted by BloombergNEF puts that figure close to US$196 trillion between now and 2050.

In addition, some of the nascent technologies are not commercially available as yet, and to be deployed at scale will require trillions of dollars within the next two decades to become market ready.

Moderated by:
Allen Tom Abraham
Head of Sustainable Materials Research
BloombergNEF

Rethinking processes and evolving partnerships

The evolution of game-changing innovations from pilot to scale require commercial incentivisation for viable deployment and success is contingent upon multiple factors.

Examples of successful global application include establishing long-term price agreements with customers able to de-risk the project. This is, however, a 'chicken and egg' problem as customers are looking for volume commitment and suppliers a pricing commitment. In this scenario, repeated piloting is key to reach a point where volume is realised and the price commitment achievable.

For small scale businesses at the forefront of carbon transformation solutions' development, securing buy-in requires persistence. Specialised solutions innovators sit at the nexus between the high emitting sectors and a consumer-facing end products, for example, are often met with heavy resistance from sector players because the applications for their technology are not fully understood. Pilot-to-commercial scale efforts, therefore, focus on repeated demonstration of continuous production at scale to deliver an informed educated perspective on potential partnerships with legacy industrial processes. And the need to invest time and effort educating potential partners across all aspects of technological implementation is a recurring theme.

Profitability inevitably forms part of the discussion around technology innovation. The easiest innovations to scale are those where decarbonisation potential is clear-cut and the profitability outlook is overwhelmingly positive. The possibility of converting a waste stream into a valuable product has to be front of mind. Waste heat and flare gas recovery systems, for example, improve operational thermal efficiencies but also generate useful products such as distillate water or additional clean power.

Value is also found in innovative replacement materials to boost greenhouse gas emissions reduction targets that also improve asset integrity. If materials can also be procured locally, this is an ancillary bonus.

Scaling up in the countdown to 2050

The scale-up of technologies will in part be dependent on the involvement of the financial ecosystem but getting commercial banks, investment banks, insurance companies, etc., on side is particularly challenging.

For emerging technologies like carbon capture and storage (CCS) there is no common project financing mechanism. These technologies are collectively characterised by uncertainty, which equates to unpredictability and this is a potential financing red flag. Partnerships are, therefore, critical to identify viable business models and unlock capital flows from commercial banks.

Overcoming investment inertia will be essential to scaling up these technologies. An example of the array of new solutions needed could be the implementation of Decommissioning Security Agreements (DSAs) and risk mitigation mechanisms by policymakers, companies and joint venture partners.

This connects to the importance of evaluating the full cycle and full journey of technology development, and R&D spend. The UAE Government, for example, is committed to raising R&D spend to two per cent of GDP by 2031, with a focus on high impact areas including CCS, hydrogen and other net zero-agenda driving technologies.

In addition, the introduction of a market hold mechanism could also support deployment of emerging technologies. Offtake agreements are another possible risk transfer mechanism that have the potential to help secure financing for green products. These can give investors and first mover companies a level of predictability and market assurance.

Commitment and co-investment from the government and private sector is essential for technology enablement and the scaling up to commercial viability. Public-private partnerships in the carbon capture and hydrogen space, however, require a ‘new way of doing business,’ new risk-reward parameters and in some instances an entirely new infrastructure to be built out.

Equally critical in managing the deployment of new technology is the relationship, collaboration, and trust between technologists operations and capital projects teams. In many companies there is a gap in understanding between what technologists do and what projects people do. ‘Stitch the two sides together’ and the route to deployment is streamlined; representing a stronger case when at the financing presentation stage.

For emerging technologies to reach industrial scale, the pace of technological change must also be factored in and embedded in a company’s economic assumptions, with targets communicated to the deployment teams.

Compounding the challenge is a lack of available industrial site space where existing infrastructure is at maximum capacity, with certain geographies also not suitable in terms of climate and remoteness.

Fragmented opportunity for carbon capture

On the road towards net-zero, there are many markets that remain reliant on fossil fuels and navigating the route to realising net-zero goals while also being beholden to carbon removal strategies is challenging.

Enabling carbon capture and removal to scale, and also identifying appropriate commercial mechanisms for funding and deployment is the challenge, and one being addressed differently in various geographies.

The US' Inflation Reduction Act has seen the 45Q tax credit for carbon capture and sequestration 'supercharged' in recent months, but concerns still prevail regarding the challenging regulation standpoint.

Northern Europe, meanwhile, is moving reasonably well with several energy companies pushing the agenda, driven in part by rising EU carbon permit costs. Southeast Asia is also seeing positive movement in many jurisdictions, although exponential growth is required to realise full regional potential. In countries such as Malaysia, however, there is currently no regulatory framework in place to support carbon capture, utilisation and storage (CCUS) investment and development.

Looking at the sectors where carbon capture holds the most promise. The first step is to distinguish what is pre- versus post-combustion capture. Pre-combustion capture is primarily related to the energy extraction and production and the energy industry. It is easier to manage and apply by the large industry players.

Post-combustion capture, however, is much more difficult because of the lower CO_2 concentration. This is compounded by the extended value chain applying a multitude of breakthrough technologies is in the hands of startup companies, which makes scale-up much more difficult when you start to build between the technology and the projects. Co-ordination and support across the stakeholder universe is required for acceleration.

Small players also find it extremely difficult to make their way through the procurement cycle of large industrial organisations and this has created a 'frozen middle' between the technology solution and the industrial processes.

Sectors benefiting from pre-combustion include the energy sector, particularly oil and gas, which has the capability for faster adoption; followed by the cement and steel industries, although there is less marginality, and this can increase the final cost of the product.

It should be noted that some industry players are confident that decarbonisation in the heavy industrial space will come at the same time as for oil and gas companies due to the fact there is already a market ready to pay a premium for green product. Government is often the biggest buyer, which is a checkmark for project finance opportunity.

A mature understanding of CCUS technology doesn't necessarily equate to market opportunity. In the US, for example, there is a growing challenge when it comes to pipeline permitting and storage capacity with a state-by-state approvals process.

In such a fragmented market scenario, initial identification of optimal sites strips this back to the basics. The pragmatic first step is to find the right site, progress to permitting, then create a hub that makes geographical sense. This needs to be coupled with continued open fact-based dialogue with policymakers.

An additional barrier to faster adoption is the timeline-meets-risk expectation. Energy companies would have to rethink the timeframes in which projects are evaluated (long-term vs short-term), and adjust expectations accordingly before approving a project.

Size scaling versus modular scale-up is a cost factor that can't be ignored. While size scaling has been key for industry growth, this is significantly more expensive than the modular option. The challenge here is breaking down each process into individual components and understanding which elements will size scale versus are modular to scale. This enables the handicapping of technologies based on initial versus final cost and should also be done in parallel with the Technology Readiness Level (TRL) 1-9, which is effectively a nine-step model for success. Parallelisation is key to bringing policy, technology, and infrastructure together.

Direct air capture offers a localised solution

Another technology primed for scale-up is direct air capture, but this requires compliance support from carbon markets. A key advantage of direct air capture is the potential to facilitate local air quality and, in markets like the US, where many cities are competing on the quality-of-life index with the implementation of ultra-low emissions zones, this is a potential opportunity.

There are a number of logical ways to scale the technology including the modular route plus direct air capture has minimised infrastructural needs and can also piggyback on existing infrastructure both from a capture and injection perspective. Scale up is needed to make a significant step change in the total cost of this technology.

Increasing investor interest in developing and scaling up direct air capture technologies is being reported in the US. Support through the Inflation Reduction Act is creating capability and demonstrating strong government commitment to reducing the risk from long-term markets and opening up the funding conversation.

The future is digitally powered

The influence of digital transformation in the energy sector on emissions reduction is a proof case work in progress but with the advent of artificial intelligence and its various subsets from machine learning to large language models, it will be integral to achieving net-zero ambition.

Any conversation around AI has to first acknowledge the vast amount of energy that data centres consume and, currently, the majority of large-scale data centres, for example, cannot operate off green electrons alone. On the flip side, digital strategy implementation not only yields multi-million-dollar operational cost savings but also delivers improved maintenance capabilities, green fleet overhaul opportunity, etc.

While next-generation technology is no 'silver bullet', connecting existing infrastructure to smart infrastructure through digital technologies is fundamental to be able to leverage machine learning to accelerate problems saving solutions.
AI also has a big role to play in supporting Scope 3 targets, providing automatic access to audit-ready data, and is particularly useful for sectors such as cement and ammonia production. AI can help logistics planning by identifying more fuel-efficient routes, optimise waste segregation, or improve efficiency by analysing energy consumption patterns in the supply chain.

There are hurdles to overcome. Traditional plant operations are entrenched in a legacy culture that can make it difficult for teams to be open to digital transformation and new data models. Anecdotal figures put the number of failed digital transformation projects at 50 per cent due to a lack of change management strategy and inadequate employee skill sets. 'They who hold the data, hold the future' but this is entirely without merit if there is a failure to upskill and reskill the workforce of the future.

The hot topic of generative AI is one application that offers significant potential but requires careful implementation. Novel large language models (LLMs) that are distinct from algorithmic reasoning and human thought need to be safely and reliably introduced into the operational context. It is the industry personnel at the operational level who need manage implementation to drive bottom line.

Simulation and visualisation are equally critical for successful digitalisation implementation. This rounds back to the importance of identifying the right experience and knowledge share partners.

Transformative technology can also help extend the life of existing assets. Digital twin use cases for industrial operations and legacy infrastructure, can identify ways to extend the carbon lifespan of concrete, for example.

Industry players, innovators and solutions providers must collectively step up to showcase the benefits of tech-centric long-term decarbonisation projects to government agencies, financial institutions, and insurance companies.

Consumers, globally, increasingly want to know the energy intensity involved in the creation of a product. This is where immutable blockchain analytics and technologies can support carbon footprint certification.

AI and blockchain will enable increased carbon emissions calculation transparency that will, in turn, enable the trading of low carbon products and give governments more confidence in the carbon footprint of different products.

> While next-generation technology is no ‘silver bullet’, connecting existing infrastructure to smart infrastructure through digital technologies is fundamental to be able to leverage machine learning to accelerate problems saving solutions.

ROUNDTABLE TAKEAWAYS

- Offtake agreements and pathways to profitability need more thought and work in terms of connecting the two markets together, whether it’s through policy, regulation or other means.
- Forging stronger partnerships between technology pioneers and companies operating within the hard to abate sectors will be essential to enabling commercial finance.
- Addressing the challenges of pre- versus post-combustion, it’s clear the carbon intensity of the stream is critical, and this will continue to be a topic of exploration and innovation.
- Determining what scales up and how this is achieved - whether its size scaling or modular - remains subject to the nuances of existing financial ecosystems; with strong partnerships and technology rationales key to securing funding. Opportunity can also be stymied by a lack of available industrial site space.
- Education and communication is an ongoing requirement around the topic of AI specifically and digital technology implementation generally. From policymakers and government authorities to employees and the general public, the deployment of new and different solutions requires much more time spent in conversation and information sharing. Alignment must be achieved both within an organization, as well as between partners and stakeholders.
- The power of generative AI and blockchain technologies offers the promise of greater transparency and the potential to tackle seemingly low-hanging fruit, such as methane reduction. However, these tools are no substitute for human capital and their deployment requires intense forethought and expert handling to help enable better decision making across a range of different industrial environments.

ADIPEC أديبك
نادي الشرق الأوسط للطاقة
Middle East Energy Club

Host
أدنوك
ADNOC

ADIPEC Leadership Roundtables

4-7 November 2024

Abu Dhabi, UAE

Decarbonising.
Faster.
Together.

For more information or to apply to participate in the Leadership Roundtables at ADIPEC 2024, please contact **roundtables@adipec.com**

dmg events
Office C40-L06-10, Level 6, Tower 4
Yas Island, Yas Creative Hub

PO Box 769256, Abu Dhabi, UAE
T: +971 2 4444 909
F: +971 2 4444 383
E: roundtables@adipec.com
W: www.adipec.com

ADIPEC, brought to you by:
dmg events