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Borneo Post (Kuching), Malaysia

Does CCUS have a future in Malaysia?

Soon Li Wei

AS nations race toward net-zero targets amid a narrowing window to address climate change, Carbon Capture, Utilisation and Storage (CCUS) is emerging both as a promising technological solution and a focal point of environmental debate.

CCUS is a technology designed to capture carbon dioxide (CO_2) from point sources such as factories or directly from the atmosphere.

The captured CO_2 is then either stored permanently underground or utilised as a feedstock in various industrial processes.

By physically reducing emissions, CCUS enables the creation of value-added products and services that are increasingly accepted in global markets – potentially offsetting the costs of adopting the technology.

According to the International Energy Agency (IEA), CCUS is considered a critical tool in achieving global energy and climate goals, particularly for emissions that are technically challenging or prohibitively expensive to eliminate.

In Malaysia, the passage of the CCUS Bill in March marks a significant policy shift, paving the way for the large-scale deployment of carbon capture initiatives across key industrial sectors.

While many local experts acknowledge that the bill leaves important questions unanswered – especially regarding CCUS's long-term role in meeting Malaysia's climate commitments – it is nevertheless seen as a step forward.

It represents a flagship catalyst project and a vital component of the National Energy Transition Roadmap (NETR), aimed at serving countries that seek to use CCUS to lower their carbon emissions.

As the bill awaits further development of implementation guidelines, the debate is intensifying – between supporters who view CCUS as essential for addressing hard-to-abate emissions, and critics who highlight its substantial financial and environmental costs.

Critical for net zero

Global CCS Institute Strategic Adviser for Emerging CCS (Carbon Capture and Storage) Markets Alex Zapantis said while CCUS is not a one-size-fits-all solution, it remains a vital component in the global push toward net-zero emissions – particularly in Southeast Asia.

He stressed that CCUS should not be viewed as a substitute for renewable energy, nuclear power, or energy efficiency improvements.

However, it is a crucial technology for industrial sectors where alternative solutions are currently not yet viable.

"Most international reports and analyses show that we need to use every tool at our disposal to reach net zero. If we remove any of them from the equation, it becomes more difficult, more expensive, and possibly even impossible," he told Bernama in an exclusive interview recently.

While hydrogen has been touted as a cleaner alternative for processes like steel production via direct reduced iron (DRI), Zapantis pointed out that clean hydrogen production at commercial scale still often relies on CCS.

"To produce low-emission hydrogen, CCS remains the most cost-effective and scalable method available today," he said.

On the energy front, Zapantis also addressed a common misconception: that CCS competes with renewable energy. He argued that in Southeast Asia's context, the two should be seen as complementary.

"We need as much renewable energy as we can deploy, but there are limits to what the grid can handle due to the intermittent nature of these sources. CCS complements renewables – it's not in competition with them," he added.

Nature-based solutions

When asked whether nature-based solutions (NbS) such as forests and green carbon sinks could replace CCUS in absorbing carbon dioxide, Zapantis said these approaches, while important, have inherent limitations.

"NbS play a vital role in addressing climate change, but they cannot replace CCUS. They are limited by land availability and offer far less security compared to underground carbon storage through CCS."

Citing findings from the United States National Academies of Sciences, Engineering, and Medicine, Zapantis noted that the upper limit of effective carbon dioxide abatement through NbS globally is estimated at just five to seven gigatonnes per year.

"Beyond that threshold, NbS begin to compete with essential needs such as food production, fibre, water, and biodiversity. When you consider that global emissions stand at around 40 gigatonnes annually, NbS can only provide a fraction of what's required," he said.

Zapantis said that another key challenge with NbS is permanence – the durability of carbon storage over time.

"CCS offers a more secure form of storage. Thanks to over a century of oil and gas operations and decades of geological research, we know that carbon dioxide, when stored in a properly selected underground reservoir, remains there.

"Even if leakage occurs, it can be detected and remedied with existing oil and gas technologies," he said.

In contrast, carbon stored in trees or soil is vulnerable to natural and human-induced risks such as wildfires, pests, droughts, and land-use changes.

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"If those trees are lost – whether due to fire, disease, or logging – the carbon is released back into the atmosphere. The risk of reversal is significantly higher compared to CCS," he added.

Zapantis argued that the most effective strategy is to prevent emissions from entering the atmosphere in the first place.

"CCUS achieves this by capturing carbon dioxide directly at the source – be it a power plant or industrial facility – and storing it securely. That's far more effective than emitting carbon and trying to remove or offset it later," he said.

When asked whether CCUS could be misused as a licence to prolong fossil fuel use, Zapantis was firm in his response.

"CCUS should be seen as one element of a broader climate strategy that includes renewables, energy efficiency, and nature-based solutions. It's not about extending the life of fossil fuels. It's about managing emissions from hard-to-abate sectors.

"In Southeast Asia, where energy demand continues to rise and fossil fuels still dominate the energy mix, CCUS is essential to achieving emissions targets," he said.

Safety matters

While CCUS is being promoted as a key technology to help Malaysia and Southeast Asia achieve their net-zero targets, concerns persist particularly around the safety and reliability of offshore carbon storage.

Climate policy expert Dr Gary Theseira warned that current monitoring technologies are not yet mature enough to guarantee the secure containment of carbon dioxide injected beneath the seabed.

This raises serious questions about the risk of undetected leaks and the long-term liabilities associated with such storage, he said.

"At present, there is no existing technology capable of effectively monitoring the seabed once CO_2 is injected offshore.

"If a leak occurs, the gas dissolves into seawater almost immediately, making it virtually untraceable," he told Bernama.

Theseira, who also serves as Chair of the Climate Governance Malaysia Council, noted that NbS are already playing an active role in carbon sequestration.

"We already have forests and natural carbon sinks doing the job. Perhaps we should be channelling more investment and attention into enhancing these systems," he said.

He cited biomass waste such as pruned branches and deadwood as a valuable resource that could be transformed into biochar, a more stable and potentially safer method of carbon sequestration.

"For me, the most promising alternative is biochar. It's a form of CCUS, just with a different, more grounded approach—and potentially less risky," he said.

Biochar is a charcoal-like substance produced by burning organic material from agricultural or forestry waste (biomass) in a controlled process known as pyrolysis. Although it resembles common charcoal, biochar is made using a method designed to minimise contamination and securely store carbon over the long term.

Need for coherent policy framework

Theseira said the government should consider passing the long-delayed National Climate Change Bill (RUUPIN) before advancing the CCUS Bill or implementing a carbon tax.

He warned that without a coherent legal and policy framework, efforts to combat climate change – through mechanisms like CCUS and carbon pricing – risk becoming fragmented or even counterproductive.

"All of these mechanisms – CCUS, carbon tax, and broader emissions regulations – must align toward the same outcome," he said.

"Otherwise, we risk different sectors lobbying for conflicting interests, as we've already seen in the automotive sector."

On Feb 5, then Minister of Natural Resources and Environmental Sustainability Nik Nazmi Nik Ahmad said the government is in the process of drafting RUUPIN as part of its broader strategy to achieve net-zero emissions by 2050.

He noted that meeting this target would require radical transformations across government, industry, and society.

Frustration intensified when then Minister of Economy Datuk Seri Rafizi Ramli announced that the government aimed to enforce CCUS legislation by March 31 to attract long-term investment opportunities.

The accelerated timeline sparked concern that the push for CCUS is being driven more by economic incentives than environmental integrity.

This has led to criticism from environmental NGOs, who argue that Malaysia may be prioritising foreign investment over safety and sustainability. Concerns have also been raised about the country's readiness to manage potential risks such as leaks, especially if Malaysia begins importing carbon waste for storage.

Risk of leakage

Sahabat Alam Malaysia president Meenakshi Raman has urged the government to address the risk of water contamination from potential leakage at CCUS sites into adjacent geological formations.

She argued that the current CCUS Bill lacks adequate safeguards to protect the environment and public health, and called for urgent improvements before Malaysia proceeds with any CCUS project bids.

"CCUS projects have been associated with high rates of failure and cancellation. They are also susceptible to significant cost overruns and may result in stranded assets," she said.

Meenakshi referred to a report by a United Nations Special Rapporteur on the toxic impacts of proposed climate change

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solutions, which highlighted the chemical intensity of the carbon capture process.

According to the report, this process can release substantial quantities of hazardous substances, including highly toxic ammonia, into surrounding communities.

"At high concentrations, carbon dioxide itself is a toxic gas and an asphyxiant. It can cause circulatory insufficiency, coma, and even death," she warned.

She also raised concerns about the lack of inclusive representation in the decision-making process for CCUS implementation.

"To date, civil society and community-based groups have not been included in CCUS agency meetings. All appointments are made at the ministry's discretion, which limits transparency, accountability, and the diversity of perspectives – especially those that may challenge government or industry priorities," she added. — Bernama

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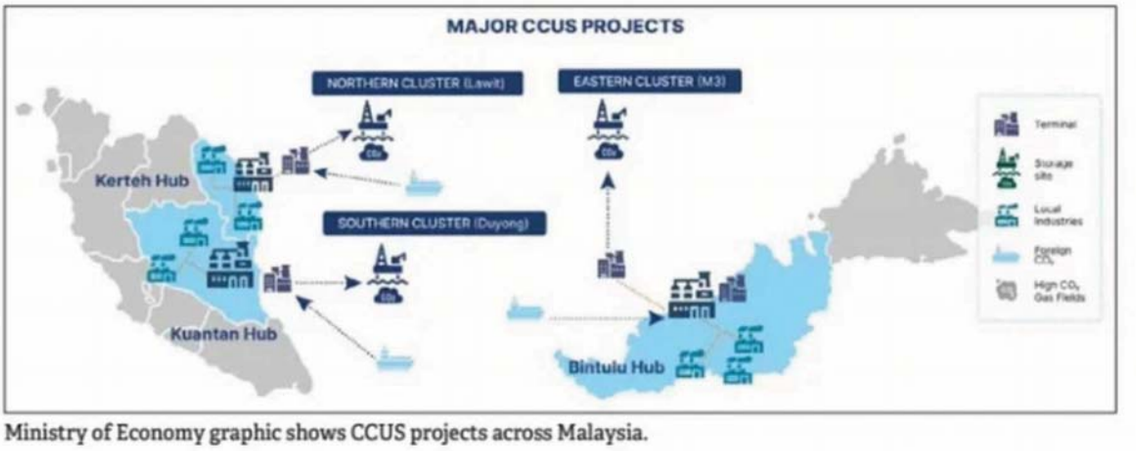

Ministry of Economy graphic shows CCUS projects across Malaysia.

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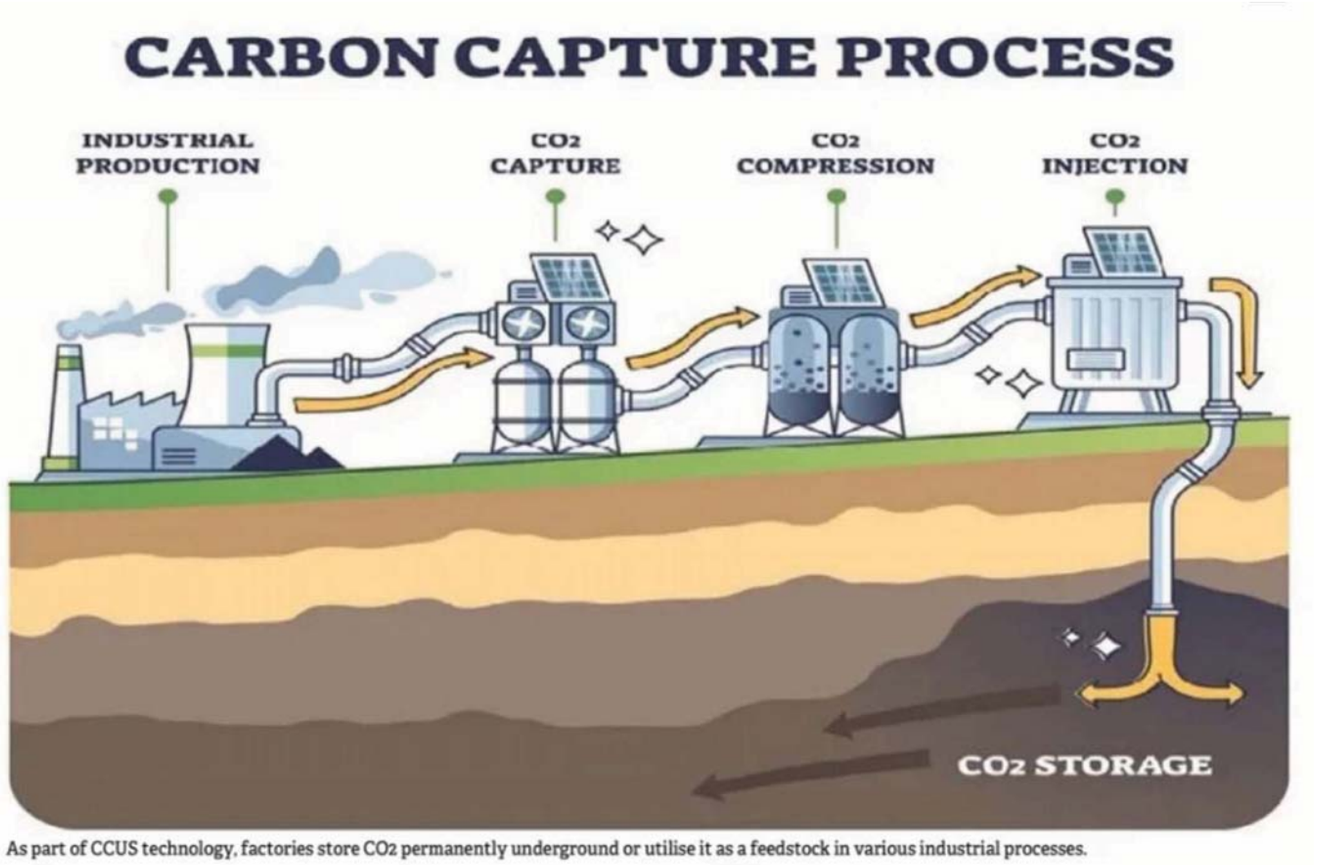

As part of CCUS technology, factories store CO_2 permanently underground or utilise it as a feedstock in various industrial processes.