SINGAPORE maritimeweek® 2024

A day of intense discussions and debates

Decarbonisation and digitalisation can help spur progress if viewed together

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The synergies between digitalisation and decarbonisation can help tackle pertinent challenges in the maritime industry.

The maritime sector should not view digitalisation and decarbonisation as separate issues but twin forces that have the ability to generate progress together, said Dr Amy Khor, Senior Minister of State for Transport and Sustainability and the Environment.

Speaking at the opening address of the Accelerating Digitalisation and Decarbonisation Conference on Tuesday, she said that industry players should consider both efforts in combination to "spark new ideas, insights, and opportunities".

"(Digitalisation and decarbonisation) are working in tandem – advancements on one front have the potential to spur developments in the other," she said on Day Two of the Singapore Maritime Week.

Decarbonisation presents inherent challenges, as "many uncertainties relating to technological capabilities, supply chains, and safety remain," said Dr Khor. The synergies between digitalisation and decarbonisation can mitigate some of these challenges.

"Digital solutions can facilitate and accelerate the industry's decarbonisation efforts through optimising energy consumption, facilitating carbon accounting, or even addressing safety concerns relating to future fuels," she added.

She cited the Maritime and Port Authority of Singapore's (MPA) Just-in-Time Planning and Coordination Platform as a key example. Launched in October 2023, the platform, used by more than 1,000 vessels, gives port users real-time visibility of berthing schedules. This enables them to better coordinate vessel arrival times, thereby improving schedule reliability and saving costs. At the same time, the decreased idling time helps reduce emissions from vessels.

The importance of digital technologies was also a key focus for Mr Greg Wilson, Microsoft Worldwide Public Sector's Chief Technology Officer for Government. In his keynote address on big data, he said that data can make huge waves in maritime, if industry leaders embrace it in a big way.

To illustrate his point, he posed a question to the audience: when it comes to Formula 1, which is the most valuable car?

"It is the digital twin. Because the digital twin can be made to practice, work out what the failures are, and reset before you do something physical. That's no different from designing ships and ports and the transportation that goes around there," he said.

He urged industry leaders to make the digital shift sooner than later. "Those who are embracing Artificial Intelligence early, and thinking about (going from) small steps to scaling, are delivering innovative solutions faster and quicker than those at the bottom." ∎

> **"(Digitalisation and decarbonisation) are working in tandem – advancements on one front have the potential to spur developments in the other."**
>
> **Dr Amy Khor**
> Singapore's Senior Minister of State for Transport and Sustainability and the Environment

Three ways to accelerate progress

The digitalisation and decarbonisation shift in the maritime sector is an opportune moment for the industry to refresh its image, said Dr Amy Khor, Senior Minister of State for Transport and Sustainability and the Environment. And the Maritime and Port Authority of Singapore (MPA) will support the transition from Singapore in three key ways, she added.

New solutions:
MPA will develop and testbed novel solutions to address real-world challenges in the industry. On the digitalisation front, MPA is now exploring the adoption of Artificial Intelligence to enhance safety and efficiency in maritime operations. On decarbonisation, MPA is working with the Energy Market Authority to review proposals to develop a solution that provides low- or zero-carbon ammonia for power generation and bunkering.

Facilitating collaborations:
MPA will link like-minded public and private sector partners to work on digitalisation and decarbonisation solutions. Five such collaborations will be formalised over the course of the Singapore Maritime Week. This includes a Memorandum of Understanding signed by MPA, financial information services provider S&P Global Market Intelligence, and bunkering solutions provider Bunkerchain, to pilot the use of digital ship identity in port clearance and bunkering.

Mitigating risks:
As new decarbonisation solutions are tested, MPA will consolidate learning points and insights to help develop regulatory frameworks and standards to ensure a safe and reliable net-zero transition. It will also support efforts to strengthen the sector's cybersecurity capabilities, as ship and shore-based digital systems become more interconnected. One example is the new MaritimeSG Shipping CyberSafe Scorecard by not-for-profit trade association Singapore Shipping Association. The free self-assessment tool will help shipping companies assess the cybersecurity maturity levels of their operations, and identify and mitigate weak points. ∎

Mr Roberto Cazzulo, IACS Council Chair, delivering his introductory remarks during a series of presentations on maritime AI.

The **human element** lies at the heart of Maritime AI

AI can augment human capabilities for a cleaner, safer, and more efficient maritime industry.

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With the rapid adoption of digital technologies, the maritime sector could see an Artificial Intelligence (AI) revolution by 2028 – one that seeks to empower people in the industry with greater autonomy.

"We are going into a period when most conventional ships will become smart ships," said Mr Roberto Cazzulo, International Association of Classification Societies (IACS) Council Chair, in his introductory remarks during a series of presentations on Maritime AI on Tuesday.

His prognosis follows industry forecasts that he cited, with spending on AI solutions expected to burgeon by almost three times from US$931 million in 2022 to US$2.7 billion by 2027.

Despite the rise of AI, the three speakers at the presentations noted that AI is not intended to replace humans entirely, but enhance their capabilities in areas like maritime safety, predictive maintenance, and decarbonisation.

There is a misconception that AI-enabled maritime autonomy refers only to unmanned vessels, when in reality, "autonomy is a ladder with many steps", said Mr Erik Dyrkoren, Chief Executive Officer (CEO) and Co-Founder of Zeabuz, a Norwegian autonomous ferry start-up.

"Autonomy adds significant value to maritime operations by making them safer, leaner, and greener," he added.

For instance, digitally-enabled autonomous solutions can augment human attention and situational awareness for safer navigation.

South Korean company Seadronix has already developed an AI-based berthing monitoring system that helps large vessels berth safely at congested ports, which is in use at the ports of Busan and Incheon.

"Usually, operators are still watching screens with the naked eye and this requires a lot of human interpretation," said Mr Noh Kyongsoo, CEO of Seadronix. "With real-time information provided by AI, humans only need to decide whether or not to follow these instructions."

Similarly, Singapore's Agency for Science, Technology and Research (A*STAR) is developing maritime applied solutions, said Dr Su Yi, Executive Director of the Institute of High Performance Computing at the organisation. This includes ongoing trials for AI-powered systems to facilitate Just-in-Time Arrivals, which are estimated to save 11 per cent of fuel consumption and reduce wait times at ports by four to five hours.

One main challenge in maritime AI remains acquiring, handling, and sharing the reams of data that are exchanged in the industry, although there are viable solutions such as integrating blockchain with AI or using large language models to help users easily search and retrieve information from huge repositories.

In fact, Mr Cazzulo sees these challenges as opportunities. "We have to face these opportunities with future logic, not yesterday's logic," he said. ∎

Large-scale adoption of drone technology will **require industry cooperation**: panellists

Drone technology is already advanced – now stakeholders need to cooperate for its large-scale application in maritime.

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Drones have the capability to do much more in maritime but their less-than-ideal adoption rate means that they have not lived up to their potential, said panellists on Tuesday.

Drones already contribute to Singapore's maritime industry through delivery, inspection and security capabilities. However, applying drone technology on a large scale will require cooperation between stakeholders.

Speaking at the Maritime Drones panel at the Accelerating Digitalisation and Decarbonisation Conference, Mr Haakon Ellekjaer, Chief Commercial Officer at Pelagus 3D, an additive manufacturing solutions provider, said that the technology to do more was not an issue.

"The main challenge is not actually the technology, but a shift in mindset by the industry. We need to start working together," he said.

One area in which more cooperation is needed is in regulation, especially since drones often move in and out of different countries' airspaces, said Mr Ryan Lee, Founder of Heron Airbridge, an unmanned aerial systems service provider.

"That is when stakeholders need to come together to agree on common protocols for regulation," he added.

Mr Tan Kah Han, Chief Technology Officer and Senior Director (Unmanned Systems Group) at the Civil Aviation Authority of Singapore (CAAS), said that CAAS is working with the Maritime and Port Authority of Singapore (MPA) to lay down such regulations for the safe and secure use of drone technology.

But he also challenged operators to help regulators by "coming up with exciting and innovative solutions to help address safety concerns".

Mr Sanjay Suresh, General Manager (Asia Pacific) at Skyports Drone Services, a drone provider and operator, detailed one such solution his firm has adopted – Artificial Intelligence which helps ensure that drones do not fly over anchored ships.

Besides regulation, Ms Amel Rigneau, Head of ZEBOX APAC, a start-up accelerator, noted that the industry needs to create a favourable ecosystem that will facilitate the adoption of drone technology. This includes training and the recruitment of specialists in the industry.

"We need training and certification for operators, as well as onboard manufacturers and specialists. This will help with the scalability of drone technology and its adoption," she said. ∎

Is the **maritime unicorn** right before us?

Venture capitalists offer their hot, opposing takes.

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Four venture capitalists (VCs) took the stage on Day Two of Singapore Maritime Week, reminiscent of a scene from popular reality TV show Shark Tank.

Instead of investors asking entrepreneurs the tough questions, however, the spotlight was on the "sharks" this time. Then came the billion-dollar question: Will there be a next maritime unicorn?

Drama ensued as the VCs gave biting, differing responses. The panel discussion on Investment and Venture Opportunities also dived into what makes great founders of an aspiring unicorn (a company valued at US$1 billion), and how the next big company will likely arise from the sector's digital transformation.

CAN YOU DISRUPT A MAERSK?

Venture capitalists and budding companies often find themselves in a complex sector teeming with stakeholders, from regulators and logistics companies to ship owners and operators.

"People call it B2B (business to business), but really, it's B to multiple Bs, right? This makes disruption extremely difficult and highly unlikely," said Mr Shaun Hon, Founder and General Partner at Motion Ventures. "How are you going to disrupt a (shipping giant like) Maersk? You've got to take over the whole supply chain, it's almost impossible."

Quick to disagree, however, was Mr Chua Chye Poh, Chief Executive Officer and Founder of ShipsFocus. Technology will be a key driver in a potential disruption. For example, platform technologies that consolidate data in a super app could address multifaceted industry issues.

A potential unicorn could be like one's "soulmate" who is not so familiar at first, he said to laughter from the audience.

"Unicorns don't look familiar immediately. (They) follow an exponential curve in terms of gaining attraction," he added, pointing to how investors looking for quick, short-term returns may not have taken note of behemoths like Amazon and Alibaba when they started.

DREAM TEAM

What is undeniable is that a budding unicorn – or perhaps a narwhal – will be driven by a great team of founders.

But what do VCs look for in entrepreneurs? The panel's moderator, Mr Chakib Abi-Saab, Chief Technology and Innovation Officer at marine shipping classification firm Lloyd's Register, threw out the bait.

Mr Marc Dragon went for the jugular. "A key part of survival in this industry is having a very deep understanding of the industry," said the Managing Director of Reefknot Investments, adding that knowledge of adjacent industries such as trade and logistics is also vital.

To Mr Haymon Sinapius, Investment Director at Innoport, a top management team is arguably more important than the brightest idea. "An A team with a B idea is more likely to succeed than a B team with an A idea," he said.

Such a B team may also turn off investors with the wrong attitude, added Mr Hon. "When a start-up expects us to come in and save them, that makes it very difficult to have a relationship," he said. "What's really important is that they can say, 'With your capital, your strategic expertise and network, I can do this much more'."

BEGIN WITH THE DIGITAL END IN MIND

The next maritime unicorn will likely emerge from the gaps in digital transformation. While much of the spotlight is on deep technology like Artificial Intelligence and Big Data, business pursuits in these areas could be slow-burners, especially when macroeconomic conditions limit spending, said Mr Dragon.

Instead, tech-enabled services in the labour-intensive maritime sector may be quicker to go to market, he added, noting: "In different start-ups, you have different time horizons."

Whichever path VCs or start-ups take, it is clear that the traditional sector is sailing headfirst into the seas of digitalisation.

Mr Chua offered a helpful perspective for the audience, especially maritime entrepreneurs. "At the end of the day, I believe we will have a digital maritime supply chain. What role do you want to play in this?"

After all, "digitalisation is not optional", concluded Mr Abi-Saab. ∎

> **"An A team with a B idea is more likely to succeed than a B team with an A idea."**
>
> **Mr Haymon Sinapius**
> Investment Director,
> Innoport

Five minutes. That's how long each entrepreneur had to seize the audience's attention at the Pitch Arena at the EXPO@SMW on Tuesday. And perhaps catch the eye of a passing investor. From green tech and safety to smart ports and ships, presenters vied to make their ideas stand out. The biggest winner? The maritime industry.

Some members of the panel discussion were (from left) Mr Thomas Ting, Chief Digital Officer and Director (Technology & Innovation) at the Maritime and Port Authority of Singapore; Mr Kenneth Juhls, Managing Director of ZeroNorth Bunker; and Mr Richard Ho, Deputy General Manager (Fuel Department) at Ocean Network Express.

Digital bunkering: the future is now

Greater efficiency, transparency, and crew safety are benefits of digitalising the form-filling process.

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In the maritime sector, where paperwork is often filled out manually by fuel suppliers and vessel crew, going digital is only a matter of time.

"It is not an 'if', it's a 'when'," declared Mr Apostolos Boutos, the Singapore Shipping Association's Marine Fuels Committee Chairman, during a panel on digital bunkering at Singapore Maritime Week on Tuesday.

Going digital means more efficient and transparent processes, and improved safety for crew who would have less need to move between vessels.

"Filling out more than 10 forms, multiple rounds of signing by different people…The pain is real, and the benefits to digitalise are pretty clear to us," noted panel moderator Mr Thomas Ting, Chief Digital Officer and Director (Technology & Innovation) of the Maritime and Port Authority of Singapore (MPA).

Singapore has been leading the charge. In November 2023, it launched a digital bunkering initiative, making it the first port in the world to implement electronic bunker delivery notes (eBDN). Bunker suppliers have been able to issue eBDNs and bunkering documentation under the Singapore Standard, via digital bunkering solutions approved by MPA.

The potential to go digital also extends to many other documents, added Mr Dennis Ho, Co-Convenor of the Working Group on Electronic Documentation for Bunkering.

FUELLING A MINDSET SHIFT
As the push for digital bunkering continues, concerns over network connectivity, cybersecurity, cost, and resistance to change are obstacles to be overcome.

"The No. 1 challenge we face is user adoption," said Mr Boutos. "We need to convey the message that it is a very seamless, easy to use (process) that saves a lot of time."

He added that there is no cost for shipowners – this was more a matter for bunker suppliers. "As more (solutions providers) are being (approved), naturally the competition has driven prices to be quite competitive, relatively lowering the costs of adoption."

These views were echoed by Mr Richard Ho, Deputy General Manager (Fuel Department) at shipping company Ocean Network Express, which completed a digital bunkering trial last year. "To receive the eBDNs, there is no cost for us. It's cost-savings," he said.

MPA plans to make digital bunkering mandatory by the end of 2024. "It's a matter of months, I hope – (before we can say) that Singapore is the first port to have fully implemented digital bunkering," Mr Boutos added.

And it is hopefully only a matter of time before others start to adopt digital bunkering too, said Mr Kenneth Juhls, Managing Director of digital bunkering solutions provider ZeroNorth Bunker.

"I'm happy that MPA is leading the way. We need to look at (digitalisation) on a global scale, because the (industry players) are global companies operating in many jurisdictions." ∎

New agreements inked to **speed up digitalisation** in maritime

Charlene Wang

The Maritime and Port Authority of Singapore (MPA) is moving to accelerate digitalisation of the sector after it signed several agreements with technology and research partners on Tuesday.

For starters, it is collaborating with technology partner Amazon Web Services to develop the region's very first maritime Artificial Intelligence and Machine Learning Digital Hub. Among other things, the Digital Hub will enable the maritime industry to trial the use of generative AI on Green and Digital Shipping Corridors in areas such as route optimisation, lowering of fuel consumption, and carbon accounting.

MPA is also looking to trial digital ship identities with global financial services provider S&P Global and bunkering IT company Bunkerchain. The collaboration will see the Port of Singapore serving as a testbed for digital ship identities for port clearance and bunkering.

By doing away with physical ship stamps and wet ink signatures, digital identities aim to make port clearance and bunkering a more efficient, secure, and greener operation.

BOOSTING CYBERSECURITY IN THE MARITIME WORLD
To tackle cybersecurity risks, MPA will form an alliance with Estonia's Tallinn University of Technology; Foundation CR14, a research centre founded by Estonia's Ministry of Defence; Singapore Maritime Institute; and the Singapore University of Technology and Design (SUTD). Together, they will partner the maritime industry, government agencies, and tertiary and research centres in both Singapore and Estonia to improve maritime cybersecurity.

The partnership allows for joint cyber training exercises, testbedding, and skill training projects to strengthen maritime cybersecurity. Conducting joint cyber training with Foundation CR14 using the SUTD-based Maritime Testbed of Shipboard Operational Technology (MariOT) system is one area of focus. Scheduled to be delivered by March 2025, the system will be used to test cyber vulnerabilities and solutions.

To expand the pool of cybersecurity talents, MPA also inked a Memorandum of Understanding (MoU) with the Singapore Shipping Association, Singapore Institute of Technology, and SUTD to create more career opportunities and attract youths as well as mid-career workers to the sector. The MoU also aims to bolster the current maritime workforce by developing training curriculums for the industry, setting training standards, and using simulation technology to improve and accelerate learning. ∎

(From left) Superintendent Lee Ting Wei, Head of Operations and Security, Singapore Police Coast Guard; Ms Lee Yin Mui, Deputy Director, ReCAAP ISC; Professor Kentaro Furuya, Japan Coast Guard Academy; Mr Budhi Halim, Representative for ASA and FASA-INSA; and Mr Gilang Kembara, Research Fellow, RSIS.

Regional cooperation successful in combating piracy and sea robbery

It will continue to be vital in suppressing piracy and armed robbery in the region.

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Journeys have been safer for vessels plying Southeast Asian waters, with good progress made by governments and nations in the region against piracy and armed robbery.

No serious incidents have been reported in the last three years, despite a 19 per cent uptick in the number of incidents in 2023 compared to 2022. Of these, the majority was low in severity.

"That said, we must not let up on efforts to counter such incidents," said Mr Tan Hoe Soon, Assistant Chief Executive (Corporate & Strategy) of the Maritime and Port Authority of Singapore, in his opening remarks at the Anti-Piracy and Sea Robbery Conference 2024, held on Day 2 of the Singapore Maritime Week.

"Piracy and sea robbery is a transboundary problem, and addressing it requires a coordinated and collective response from all stakeholders."

DETER, DETECT, DENY
A big part of the region's success has been its commitment to cooperation and information sharing, said panellists at a discussion held during the conference.

Moderated by Professor Kentaro Furuya, Adjunct Professor at the National Graduate Institute for Policy Studies and Professor at the Japan Coast Guard Academy, the panel discussion focused on the measures taken to combat piracy and armed robbery in Asia, and what more can be done.

Panellist Ms Lee Yin Mui, Deputy Director of ReCAAP ISC, noted that many incidents of theft saw scrap metal and engine spares being stolen from ships. ReCAAP ISC refers to the Regional Cooperation Agreement on Combating Piracy and Armed Robbery against Ships in Asia Information Sharing Centre.

Tracing where these parts are taken to, and who is buying them, can help to address the root cause of the issue, she said, adding: "Once there is no demand, there will be no supply".

Patrolling boundary lines also adds another layer of deterrence, said Superintendent Lee Ting Wei, Head of Operations and Security, Singapore Police Coast Guard.

"We conduct coordinated patrols with Indonesia and Malaysia so that perpetrators know we are there and have close communication with one another," he said. "This makes sure they know that they can't use boundary lines to their advantage."

BEYOND INTERGOVERNMENTAL COOPERATION
Nations also need to play their part by collaborating closely within themselves – especially if their geography requires it.

"Indonesia is an archipelagic country, tied together by sea. Almost two-thirds of Indonesia depends on water…we need to be responsible for maintaining maritime security within Indonesia itself," said Mr Budhi Halim, who represents the Asian Shipowners' Association, the Federation of ASEAN Shipowners' Association, and the Indonesian National Shipowners' Associations.

He added that such efforts are already ongoing, with the Indonesian Maritime Security Agency, also known as Bakamla, working closely with the Indonesian Navy and Sea and Coast Guard Unit to protect Indonesian waters.

Technology, such as unmanned aerial vehicles, can also augment surveillance. But regulatory and technical hurdles must be overcome, said Mr Gilang Kembara, Research Fellow with the Maritime Security Programme at the S. Rajaratnam School of International Studies.

The urgency of such efforts is clear, amid Houthi missile attacks in the Red Sea that have put a spotlight on the safety of seafarers.

Above all, the region's success should not be taken for granted. "More can be done to totally eradicate incidents," said Ms Lee. ∎

> **"Piracy and sea robbery is a transboundary problem, and addressing it requires a coordinated and collective response from all stakeholders."**
>
> Mr Tan Hoe Soon
> Assistant Chief Executive
> (Corporate & Strategy)
> Maritime and Port Authority of Singapore

Holistic approach required to **tackle complex cyber threats**

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AI, training, and partnerships are part of the package of solutions.

Cybersecurity threats are rising in complexity, making it more difficult for the maritime industry to cope.

The only solution is to take an integrated and holistic approach to deal with the situation, which includes innovative use of Artificial Intelligence (AI), private-public partnerships, and training for maritime personnel, panellists said at a cybersecurity panel on Tuesday.

"We can't brush this increasing cybersecurity threat under the carpet," said Mr Xavier Rebour, Director at France Cyber Maritime during the Accelerating Digitalisation and Decarbonisation Conference.

For one thing, cyber threats are growing increasingly sophisticated, with a surge in state-sponsored cyber attacks, he added, calling such attacks "insidious and discreet".

Mr Igor Garis Koni, Head of Public Sector & Strategic Sales (Asia Pacific and Japan) at Google Cloud Security also added that the rise of attacks such as GPS spoofing and jamming has had a heavy impact on the threat landscape. "It has, in some ways, the most catastrophic impact in theory," he said.

Dealing with cyber threats is also a problem because of the costs associated with doing so, said Mr Ong Chin Beng, Chief Information Security Officer at the Maritime and Port Authority of Singapore.
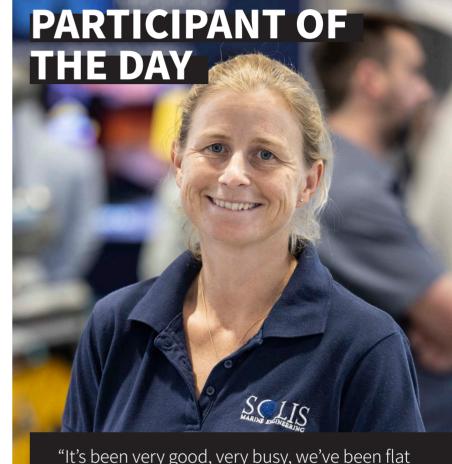
The solution to tackling such threats is to form a united front, with AI at the forefront, as well as partnerships and deep collaboration across the industry. For instance, Mr Tony Zhong, Chief Information Security Officer at the Port of Los Angeles said that the port has partnered with technology giant IBM to launch its first Cyber Resilience Center in 2022. "We created a public-private partnership to enable operations for cybersecurity," he said.

AI's capabilities lie in its promising ability to get ahead of potential cyber attacks, said Mr Ron Jimerson, Chief Information Security Officer at the Port of Seattle. "We can emulate hackers' tactics and techniques and modify them to test our own infrastructures," he said.

But digital technologies are just one part of the equation. More critically, maritime personnel will need to be equipped with the right skills.

"The human factor should be carefully considered. I think we have the potential to be the strongest link with proper training," said Captain Naoki Saito, Head of Cyber Security and General Manager of Management System and Maritime Training Department at ClassNK.

"Establishing clear roles and responsibilities play a pivotal role in increasing the capability of a cyber resilient organisation." ∎

PARTICIPANT OF THE DAY

"It's been very good, very busy, we've been flat out. It's been a very positive experience, we've had lots of good discussions already, even on the first day. We're very much enjoying it. We hope Singapore Maritime Week 2024 is an opportunity to make new connections and network with similar people working in the same space."

Ms Rosalind Blazejczyk,
Managing Director and Naval Architect of Solis Marine Consultants,
when asked about her company's experience at SMW thus far.

Tide
Turners

In this four-part series, we speak to tech start-ups that are tech-ing maritime to the next level, from advancing the decarbonisation agenda to enhancing cybersecurity and maritime safety.

For Rux Energy, hydrogen is the only way forward for the maritime industry to decarbonise. **Matthew Gan** *speaks to Dr Jehan Kanga, founder of the only non-Singaporean start-up among the winners of last year's PIER71™ Smart Port Challenge, where it claimed the third prize.*

Dr Jehan Kanga speaking to The Honourable Christopher John Minns, premier of New South Wales (left), and The Honourable Penelope Gail Sharpe, New South Wales Minister for Climate Change, Energy, Environment and Heritage (right), during their visit to the Rux Energy laboratory on 26 February 2024.

Q: Tell us about Rux Energy and what you set out to do when you first started it up.
Rux Energy was launched with the aim of developing commercial breakthroughs in hydrogen technologies, prior to our knowledge of any industry or government strategies for the hydrogen economy. It was high risk, but we knew hydrogen was the only way to decarbonise maritime, aviation, rail and heavy trucking.

Q: The world is already falling behind on its net-zero goals. What is Rux Energy's approach to this problem, especially in the maritime industry?
To help the maritime industry meet global net-zero goals, Rux has a novel strategy – focusing on the most difficult vessels to decarbonise within some of the hardest-to-abate sectors. This has an outsized multiplier effect. When you bring forward a vessel for decarbonisation from 2047 to 2027, you gain 20 years of that vessel's decarbonisation. This is our way of hacking the decarbonisation crunch that we face as a planet, and Singapore is driving forward with the most ambitious plans for the maritime sector globally. We are aligned with Singapore, and together we are going to change the world.

Q: How does Rux Energy contribute to decarbonisation in the maritime industry?
Our hydrogen storage solution incorporates patented Rux advanced nano-porous materials technology into specialised carbon fibre composite tanks to store hydrogen at moderate temperatures and lower pressures, eliminating sources of inefficiencies like boil-off. The nanomaterials used in the hydrogen tanks act like sponges, adsorbing and releasing hydrogen easily without any chemical changes or catalysts required.

The benefits are ultra-high storage energy efficiency and high volumetric and gravimetric energy densities. The nanomaterials are also non-toxic and made from abundantly available materials, further driving cost-effectiveness. Rux's goal is to directly contribute to 10 million tonnes of carbon abated annually by 2030, with maritime as our focus.

Q: What are some challenges Rux Energy has faced so far?
Since 2018, Rux has been advancing the commercialisation of our breakthrough research through a series of grants from the Australian government. The entire process has taken five years and many millions in funding to go from early to mid-stage commercialisation. At this point, Rux still requires tens of millions more in funding to develop pilot manufacturing. We are now seeking funding from industry partners to validate our hydrogen storage system in industrial environments, and hope to partner with the government and leading industry partners in Singapore.

Q: What has changed since Rux Energy won the award?
Rux has gained greater visibility in Asia and internationally, and has signed partnership agreements with universities and industry partners in the UK, Australia and Singapore. Such collaborations provide us with unique complementary capabilities, including testing and certifying our hydrogen storage systems, allowing the company to commercialise faster. We have started working with operators of harbour vessels in the UK, and hope to start working with Singaporean maritime companies to deploy our technology in one of the largest, busiest and most innovative ports in the world.

Q: What is the roadmap for Rux Energy?
We are currently scaling up our production capabilities and will deploy a demonstration system of approximately 140kg of hydrogen capacity towards the end of 2025, with larger trials and full-scale agile shore-power systems for large ships planned for 2026. If we make and sell one hydrogen tank every day by 2029, we will reach our goal of 10 million tonnes of carbon dioxide abated every year. Rux also looks forward to exploring projects with Nanyang Technological University and the National University of Singapore. ∎

The PIER71™ Smart Port Challenge is an annual innovation competition organised by PIER71™ to find the best breakthrough solutions from tech start-ups that will drive digital transformation and address key challenges faced by the maritime industry.