

NTU Singapore, PSA Singapore and Chiyoda Japan begin dehydrogenation demonstration for green heavy vehicles

in Port News 26/06/2024



Nanyang Technological University, Singapore (NTU Singapore), PSA Singapore (PSA) and Japan's Chiyoda Corporation (Chiyoda) have begun testing how hydrogen can be transported and stored as methylcyclohexane (MCH), a liquid form at ambient temperature and pressure, before gaseous hydrogen is extracted from MCH to be used as a clean fuel for horizontal transportation in the port.

As part of this collaboration and trial, PSA has built and operationalised the first hydrogen refuelling station and provided a hydrogen fuel cell electric prime mover at Pasir Panjang Terminal in Singapore.

The testbed follows successful laboratory proof-of-concept (PoC) experiments led by NTU to enable the efficient and economical transport of hydrogen, which can in turn contribute to the expansion of global hydrogen supply chains.

Hydrogen fuel cells, a promising technology for green energy, produce electricity by a reaction of hydrogen and oxygen that leaves behind only water and heat as by-products. As Singapore has no natural resources, it is reliant on importing hydrogen that can be transported in liquid form through liquid organic hydrogen carriers (LOHC), which can be used for long-term storage and long-distance transportation of hydrogen under ambient condition.

The trial at PSA's Pasir Panjang Terminal is scheduled to run until mid-2025. It aims to validate how transported LOHC can be stored at an industrial setting, and subsequently dehydrogenated. The extracted hydrogen can be used as a fuel for refuelling stations on-site.



PSA Hydrogen refuelling station and fuel-cell electric prime mover

In this PoC project, PSA provided a hydrogen refueling station and a prime mover and shares the demonstration site and utilities with industry partners. PSA is responsible for the construction, commissioning, operation, and maintenance of the hydrogen refueling facility.

This pioneering endeavour places hydrogen at the forefront as a potential sustainable green energy source and plays a pivotal role in expanding the use of hydrogen fuel within PSA and in Singapore. This collective effort demonstrates that hydrogen remains a viable decarbonisation pathway through demand aggregation and innovation.



WEEKLY DRY TIME CHARTER ESTIMATES

PERIOD	4/6 MOS		1 YR		
	ATL	PAC	ATL	PAC	ATL
HANDY (sh. det)	13,000	15,250	13,000	15,000	11,850
SMAXULTRA	17,500	17,500	17,000	16,500	16,850
PANAMMAX	21,500	16,000	17,000	16,000	16,000
CAPE SIZE	24,000	24,000	23,000	23,000	23,000

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WEEKLY TANKER TIME CHARTER ESTIMATES

SIZE	TANKER TIME CHARTER ESTIMATE (\$/dpr)		
	1 YEAR	2 YEAR	3 YEAR*
HANDY	28,000	26,000	24,000
MR IMO3	30,000	27,000	29,000
LR1	39,000	34,000	33,000
LR2	51,500	42,500	44,500
AFRA (115k dwt)	50,000	42,500	43,500
SUEZ	45,000	42,500	45,500
VLCC	47,500	45,000	54,500

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WEEKLY CONTAINER INDEX

New ConTex - all rates in USD(\$)

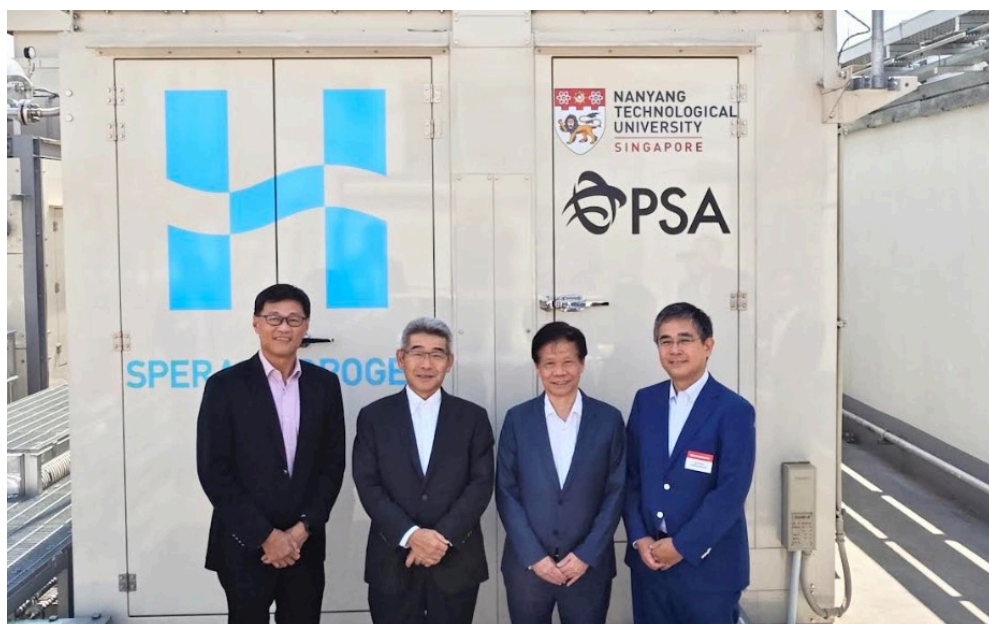
date	New Context					T
	6 months		12 months			
	Type 1100	Type 1700	Type 2500	Type 2700	Type 3500	
25.06.2024	12.798	22.109	28.614	31.209	36.715	4:
20.06.2024	12.466	20.855	27.786	30.177	35.230	4:
18.06.2024	12.270	20.045	26.695	28.968	34.195	3:

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future with alternative sources of energy that are reliable and economical. NTU supports Singapore's vision of becoming a sustainable nation, and is committed to environmental sustainability through impactful, real-world innovations."

Mr Nelson Quek, Regional CEO Southeast Asia, PSA International, said: "In collaboration with like-minded industry partners, we are excited to commission the first hydrogen refuelling facility in the port, a significant step forward in our efforts to develop a hydrogen refuelling ecosystem in Singapore. PSA will continue to seek potential technologies and actively test-bed low-carbon, innovative sustainability solutions that can be deployed beyond the industry, as we strive to collectively decarbonise and drive greener outcomes across the entire value chain."



Group photo at the SPERA dehydrogenation plant

Chiyoda, headquartered in Japan, provides technical expertise through SPERA Hydrogen™, their proprietary technology that uses dehydrogenation catalysts to extract hydrogen from MCH as LOCH for storage and transportation as a liquid form under ambient conditions.

As an advanced technology provider and key project partner, Chiyoda is collaborating with NTU by applying their engineering expertise and experience to develop and implement the technology on a national scale, and providing their dehydrogenation skids to extract hydrogen from MCH.

Mr Koji Ota, President & CEO, Chiyoda, said: "We are delighted to commence this demonstration using hydrogen for an industrial application which will lead to long-term CO2 emission reductions in Singapore, and contribute to global decarbonisation through SPERA Hydrogen. Chiyoda will further accelerate the expansion of its hydrogen value chain business towards a sustainable future by maximizing the unique advantages of our SPERA Hydrogen system, including its stability under ambient temperature and pressure, its safe and easy-to-handle characteristics and its cost competitiveness, intensified by using existing petrochemical infrastructure and regulations and standards, as demonstrated by this project which operates under existing laws. This project is of great significance to Singapore and is a major step forward toward the future diffusion of hydrogen on a global scale."

Source: PSA Singapore

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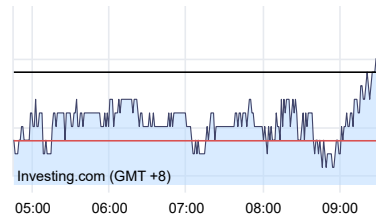


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USD/JPY	160.57	-0.22
EUR/GBP	0.8465	+0.0003
EUR/JPY	171.56	-0.21
USD/CNY	7.2678	+0.0013
AUD/USD	0.6646	0.0000

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