

Sustainability

‘Hidden benefits’ could change shipping’s hydrogen equation, study finds

Research puts annual health gains from full transition at \$284bn



Professor Steve Yim is the founding director of the Centre for Climate Change and Environmental Health at Nanyang Technological University. Photo: NTU

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Shipping's debate over hydrogen has focused too narrowly on high costs and investment risks while overlooking potential public health benefits that could reshape the economics of maritime decarbonisation.

Those are the findings of a peer-reviewed study led by researchers at Singapore Nanyang Technological University (NTU).

It estimates that shipping's full transition to hydrogen could prevent about 129,400 premature deaths each year, with associated economic benefits of about \$284bn annually.



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The figure represents monetised societal health benefits rather than revenue or direct savings accruing to shipowners.

Speaking to TradeWinds before publication, Professor Steve Yim, founding director of NTU's Centre for Climate Change and Environmental Health, stressed that the study is not intended to persuade shipowners to adopt hydrogen at all costs.

Instead, he said it demonstrates why alternative marine fuels should be evaluated more comprehensively, taking into account their wider environmental and public health impacts.

Yim said: “The hydrogen adoption in the shipping sector can save around 130,000 premature mortalities in a year. That can be equivalent to around \$284bn.

“Given this kind of air quality, health and economic benefit ... that would substantially offset the high initial cost of the hydrogen energy transition.”

The estimates carry substantial uncertainty, with the researchers putting the confidence interval at about 64,000 to 206,000 avoided deaths and \$156bn to \$437bn in economic benefits.

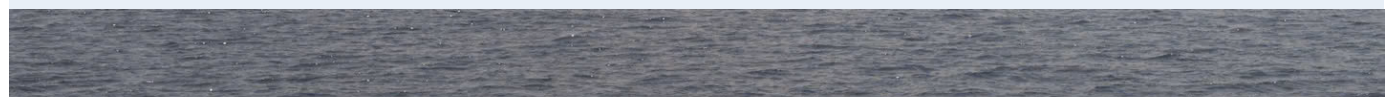
The researchers argue those societal gains should form part of future investment and policy decisions rather than leaving hydrogen to be judged primarily on its upfront costs.

The paper uses an integrated emissions, air-quality and health modelling framework to assess the health and economic impacts of potential hydrogen transition scenarios.

Under the study’s full-transition scenario, all shipping energy demand is supplied by hydrogen and operational shipping emissions are assumed to fall to zero. Emissions associated with hydrogen production are included separately.

Yim repeatedly described the societal savings as “hidden benefits” that have largely been excluded from commercial assessments of hydrogen.

While investors and shipowners naturally focus on capital costs and infrastructure constraints, Yim argues that cleaner air, improved public health and reduced healthcare expenditure also have tangible economic value that should influence investment decisions.





The Hydrobulk ship from LH2 Shipping, powered by liquid hydrogen (LH2). Photo: LH2 Shipping/Sigve Hoff Larsen.

The researchers estimate that about 75% of the avoided deaths would come from reductions in ozone exposure, with the remaining quarter due to lower fine particulate matter concentrations.

Eastern Asia would see the largest particulate-related health gains, while Southern Asia would see the greatest ozone-related benefits.

India would receive the largest overall economic benefit, followed by Japan, the US, Italy and China, according to the modelling.

China would also record the biggest reduction in particulate-related premature deaths, which Yim attributed to the relatively high existing impact of shipping emissions in the country.

One of the study's more surprising conclusions is that not every country would

benefit. Singapore is projected to experience a higher ozone-attributable mortality burden under the full hydrogen transition scenario because reducing nitrogen oxide emissions can increase ozone formation in densely urbanised environments.

The paper also concludes that hydrogen does not eliminate pollution. While emissions from ships fall sharply, additional emissions associated with hydrogen production shift some environmental impacts onto land. Yim said maximising the share of green hydrogen would substantially reduce those upstream emissions.

Although the study acknowledges that hydrogen deployment still faces significant obstacles, including limited production capacity and high investment costs, Yim compared the industry's current scepticism with the early years of electric vehicles.

He argued that focusing solely on today's infrastructure constraints risks overlooking the long-term benefits that could justify greater investment.

The findings also have implications for shipping regulation, Yim said.

He believes future policy discussions at the International Maritime Organization should evaluate alternative fuels not only by greenhouse gas reductions but by their broader environmental and health co-benefits, enabling policymakers to maximise the overall return on decarbonisation investments.



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Yim also suggested governments should view support for cleaner shipping as investment that could reduce future healthcare costs rather than simply subsidising industry.

“You would rather pay for the medical expenses, or you would like to invest in such kind of solutions to avoid future medical expenses,” he said.

The paper was published on 29 July in the journal [Nature Communications](#).

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