Eliminating methane slip

by Steve Esau, *COO, SEA-LNG*

Net zero may feel like a far-off goal (or, for some, even an idealistic future), but decarbonisation is both a target we must achieve and one we can realise in the coming decades. Particularly where the marine industry is concerned. In just over five years' time, the first of the most central International Maritime Organization's (IMO) targets will be upon us, and maritime must find a way to reduce its greenhouse gas (GHG) emissions by at least 20%. Just two decades later, the industry must achieve net zero and continue to operate in a decarbonised future.

Liquefied natural gas (LNG) presents a viable, realistic, scalable pathway to achieving key IMO and EU environmental milestones from now until net zero in 2050 and beyond. With LNG, bio-methane, and later e-methane, owners and operators have an immediate and long-term way to reduce emissions – and do so with a commercial and scalable fuel that's compatible with the existing asset base. For LNG to continue its momentum, attention must be focused on resolving the challenge of methane slip.

LNG today – and in 2030-2050

The uptake of LNG has been increasing at a rapid rate throughout the 2020s, accelerated by its availability, economics, and immediate emission impact. Today, some 590 vessels are on the water operating with the fuel, and over 560 have been ordered to operate with LNG (excluding carriers). LNG bunkering is also available in approximately 185 ports worldwide; by 2025, this figure is due to increase by another 50.

Critically, the marine industry is already looking beyond LNG at liquefied bio-methane – often referred to as bioLNG – to further enhance emission reductions and achieve the IMO's targets. Liquefied bio-methane bunkers are already available in some 70 ports across key trade routes in Asia, Europe, and North America. And in 2022 alone, the production of biogas, which is liquefied to make the fuel, grew by 20%. The Baltic region pioneered LNG as a marine fuel, and its use is widespread in ferries, container vessels, tankers, and bulk carriers, with LNG available in about 30 ports and half a dozen LNG bunkering vessels operating in the region.

Amongst the primary drivers behind LNG's growing demand is its ability to achieve both immediate and long-term emission reductions. In its current form, LNG can reduce GHG emissions from marine propulsion by up to 23%. This immediately realises the IMO's target of reaching >20% GHG reductions by 2030. It also reduces nitrogen oxide emissions by up to 95%, improving public health and drastically minimising air pollution – two key factors that are set to feature more dominantly in the decarbonisation discussion in the coming years.

We can see bio-methane as a natural progression along this pathway. Adopting it can get GHG emissions down by as much as 80%; when produced from anaerobic digestion of manure, reductions can be as high as 188% vs traditional marine fuels. Beyond this, e-methane (or synthetic LNG) is fully compliant with the IMO's 2050 targets and can result in fully carbon-neutral operations, which would see the industry successfully realising a net-zero future.

A core advantage of the LNG pathway is its commercial viability now and in the next two decades. Because LNG, bio-methane, and e-methane can be deployed using existing infrastructure, it's a lower CAPEX solution in comparison to many other common alternatives. This isn't to say that further investments won't be required as we look even further down the line. We need to accommodate what will likely be booming demand in our supply chain by expanding bunkering infrastructure and access globally. And importantly, we will need to remove the most contested aspect of LNG as a future fuel: methane slip.

Becoming a thing of the past

Methane slip is a recognised challenge for the LNG pathway. In short, when the fuel is burned, small amounts of methane may not be combusted and can be released into the atmosphere. However, it's important to highlight that this is an issue that the industry is aware of and is well on the way to resolving.

High-pressure (HP) dual-fuel engine technologies already exist with virtually no methane slip. For low-pressure (LP) engines, where this remains an issue, continuing innovations by engine manufacturers have resulted in levels of methane slip falling more than four-fold over the past 25 years.

Today, approximately 75% of LNG-fuelled ships on order have HP engines with effectively no methane slip, and if we continue at our current rate of advancement, it's likely that this matter will become a thing of the past within the next decade.

In fact, today, we are already seeing a range of methane slip initiatives targeting its elimination. **As part of the EU-funded GREEN RAY project, Wärtsilä has piloted technologies on Wasaline's *Aurora Botnia* ferry**, resulting in further methane slip reductions in one of its most popular and already emission-efficient, dual-fuel LP four-stroke engines.

The Methane Abatement in Maritime innovation initiative (MAMii) has also begun a process of piloting methane abatement technologies to reduce – and eventually eliminate – methane slip. It will also expand collaboration and lobbying with regulators on methane measurement, certification, and validation protocol. To cite one more example, **Maran Gas announced the installation of methane measuring and abatement technology in September 2023 on a dual-fuel LNG carrier**.

These are only a handful of real-time, real-life examples of rapidly progressing technology. The investment into eliminating methane slip will not only support GHG emission reductions and the realisation of the IMO's ambitious targets but is also a clear demonstration of the industry's focus on ensuring the LNG pathway meets its potential.

Waiting is not an option

As we near the end of 2024, we are on the eve of the implementation of the FuelEU Maritime, an EU Regulation which will directly regulate the emission intensity of the fuels used on board ships. Failure to comply will result in substantial financial penalties. Coupled with fleet operators receiving their first bills from the EU Emissions Trading System and the ongoing regulatory developments at the IMO, it will make decarbonisation something the industry needs to actively engage with now. Waiting is not an option.

The pathway from LNG through biomethane and finally e-methane can effectively achieve compliance with global regulations at a relatively low cost, maintaining global supply chains. Where many other fuels face significant hurdles across technological, commercial, and safety viability, LNG can be adopted using today's infrastructure and proven safe shipboard technology.

The concern around methane slip – a recognised challenge within the industry – is already being actively addressed through a number of industry initiatives, providing a stronger, more effective solution for owners, operators, financiers, and crews the world over. ■