www.bunkerspot.com Volume 22 Number 2 April/May 2025

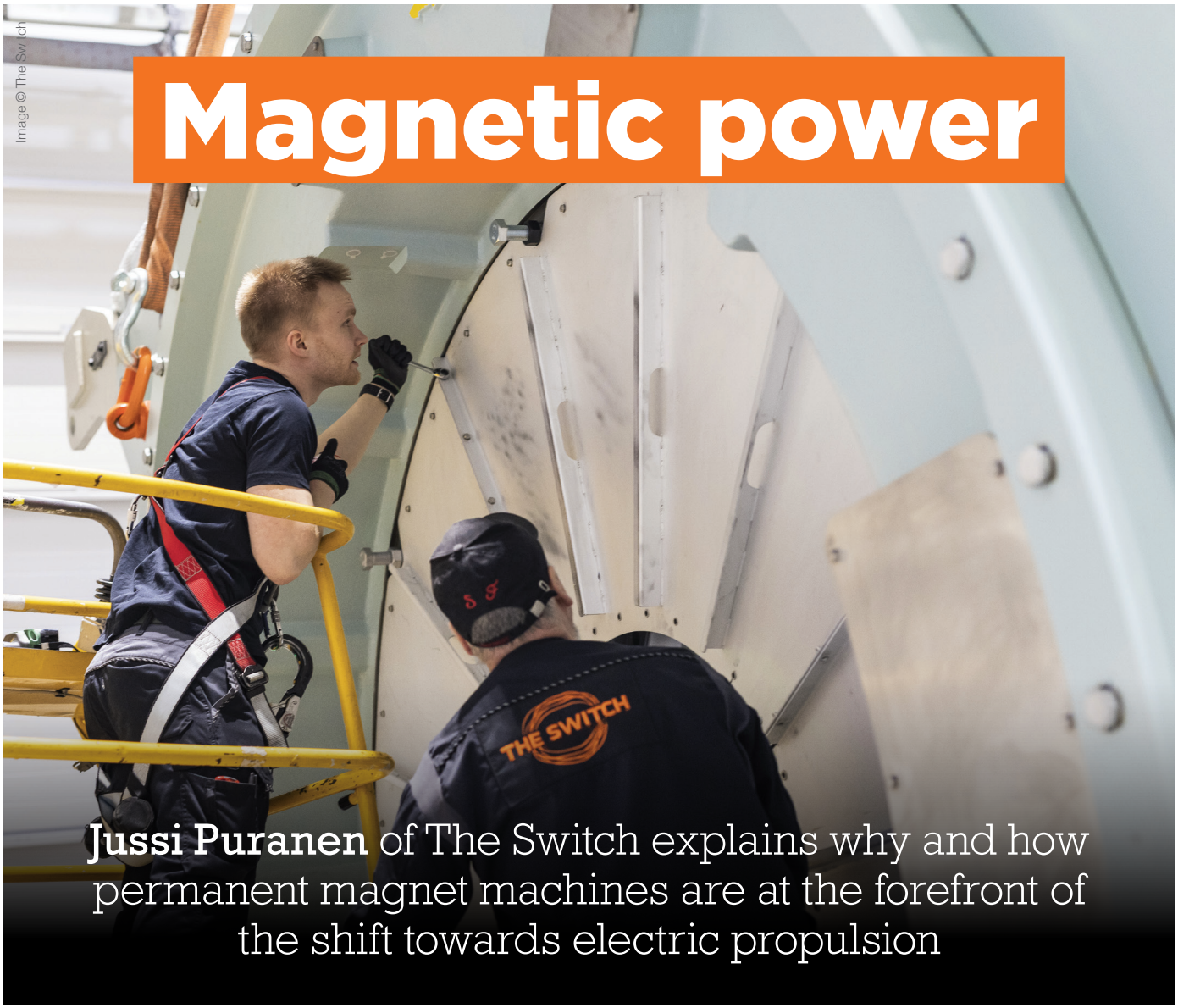
BUNKERSPOT

THE COST OF COMPLIANCE

HOW DO THE NEW FUELS ADD UP?

INSIDE:

VESSEL POOLING
CARBON CAPTURE
PORT STRATEGIES
ELECTRIC PROPULSION



Magnetic power

Jussi Puranen of The Switch explains why and how permanent magnet machines are at the forefront of the shift towards electric propulsion

As shipowners face mounting pressure to lower emissions in line with IMO targets, permanent magnet (PM) machines – used in both electric drive trains and shaft generators – are emerging as a key electrification technology that I firmly believe will be the dominant choice for electric propulsion systems in the deep-sea fleet. Until now, PM motors have been primarily used in smaller vessels, such as ferries.

EFFICIENCY: THE BACKBONE OF PM TECHNOLOGY

As everyone in shipping and the global bunker industry is well aware, fuel efficiency is not just a technical issue – it's a business-critical factor directly tied to operating costs, carbon liabilities and long-term competitiveness. As shipowners increasingly look at ways to lower both fuel bills and carbon footprints, PM machines are proving to be a transformational technology.

The fundamental efficiency advantage of PM machines comes from their inherent magnetism. Traditional electrically excited synchronous machines (EESMs) and induction motors (IMs) require continuous energy input to generate the magnetic field necessary for operation. PM machines, however, generate this field naturally through their permanent magnets, eliminating excitation losses entirely.

This core design difference allows PM machines to be 2% to 4% more efficient than EESMs and 3% to 6% more efficient than IMs under full load. Under partial load conditions, which is how most vessels actually operate for large portions of their voyages, the efficiency gap grows even wider.

For bunker buyers and operators, this translates directly into lower fuel consumption per nautical mile, reduced CO_2 emissions and lower exposure to carbon pricing mechanisms – all while maintaining the same operational profile.

SPACE AND WEIGHT ADVANTAGES: FLEXIBILITY FOR BUNKER STRATEGY

A key challenge for deep-sea shipping is balancing machinery size with available fuel storage and cargo space. PM machines offer a unique advantage, being up to 40% smaller and 50% lighter than conventional propulsion systems of equivalent power.

For ship designers and owners, this creates immediate design flexibility. Machinery spaces can be reduced, freeing up valuable real estate for additional bunker tanks – allowing for greater fuel flexibility and opportunistic bunkering at favourable prices.

This space-saving aspect is especially relevant as new fuels like methanol, ammonia and hydrogen enter the bunker supply chain. These fuels tend to have lower energy density

than traditional fuels, requiring larger storage volumes to achieve the same range. Installing compact yet efficient PM machines helps to address this challenge, easing the transition to future fuel readiness without major compromises to cargo capacity.

TOTAL COST OF OWNERSHIP: FUEL SAVINGS AND MAINTENANCE MATTER

Fuel costs typically represent up to 95% of lifetime operating expenses for the power system of a deep-sea vessel. Even marginal efficiency improvements compound into millions of dollars in savings over the vessel's operating life. PM machines, with their superior efficiency profile, directly impact this key metric, driving down fuel costs voyage after voyage.

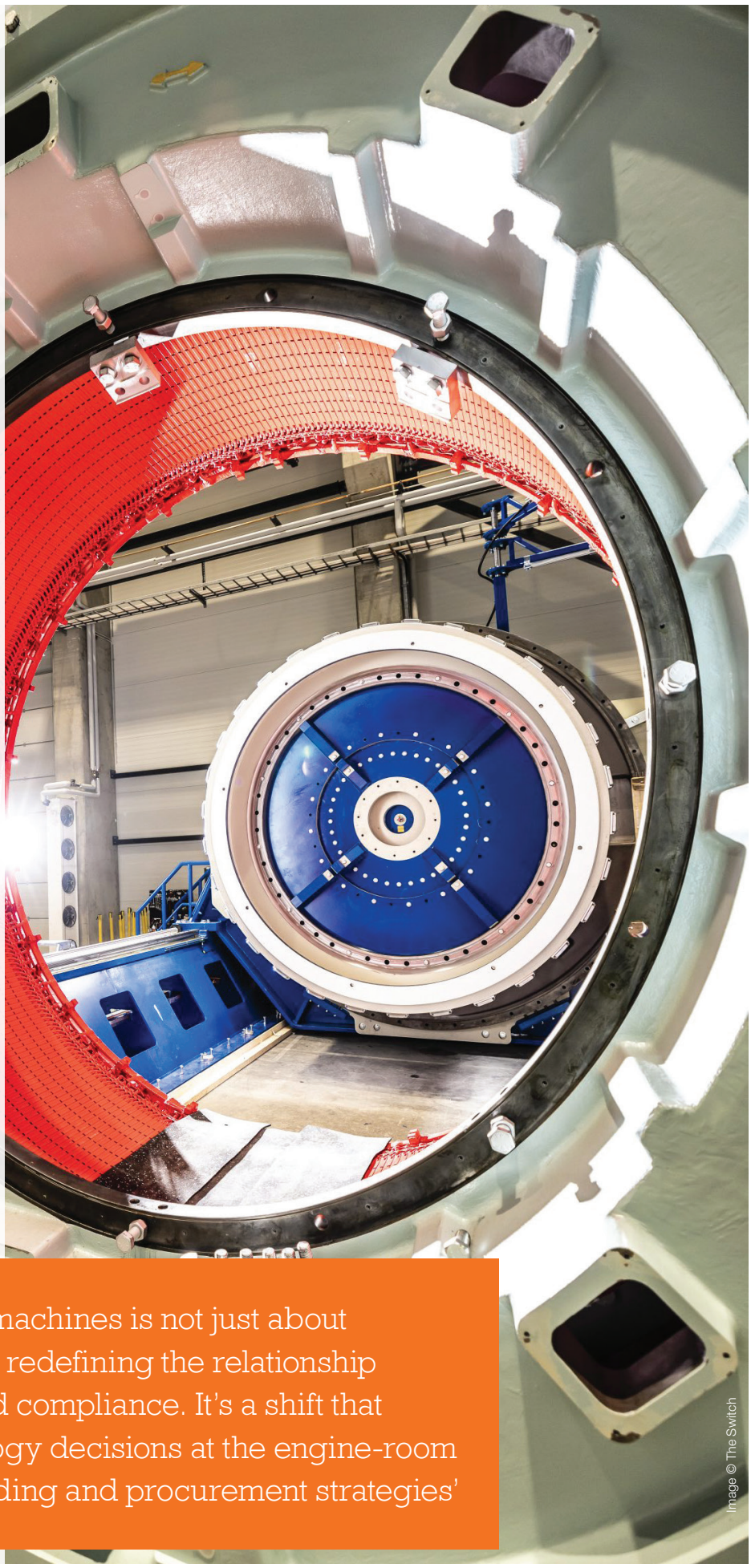
In addition to direct fuel savings, PM machines also deliver a maintenance advantage. With fewer moving parts and no excitation system, there are fewer components prone to wear and failure. This translates into less downtime, lower spare parts consumption and fewer unplanned repairs – a major benefit for owners focused on predictable fuel consumption and reliable bunkering schedules.

The net result is a lower total cost of ownership (TCO) over the life of the vessel, giving vessels with PM machines an edge in both competitive freight markets and in regulatory compliance.

DURABILITY PROVEN IN HARSH ENVIRONMENTS

PM machines are not an untested innovation – they are proven performers in some of the harshest operating environments on the planet. They have been successfully deployed in offshore wind turbines, operating reliably for decades in the salt-laden, high-wind conditions of the North Sea.

This real-world pedigree translates directly



'The transition to PM machines is not just about propulsion – it's about redefining the relationship between fuel, cost and compliance. It's a shift that directly links technology decisions at the engine-room level to global fuel trading and procurement strategies'

Image © The Switch

into confidence for shipowners, operators and charterers. Deep-sea vessels encounter similarly corrosive and demanding conditions, and the durability of PM machines offers a low-risk path to electrification.

power, allowing the vessel to reach its next bunkering port without significant disruption. This redundancy provides operational resilience, ensuring fuel planning remains intact even in the face of mechanical issues.

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This proven robustness also supports accurate fuel planning. When shipowners can trust propulsion systems to perform consistently across all operating conditions, bunker buyers can negotiate more precise fuel contracts, minimising safety margins and improving cost efficiency.

QUIET AND EFFICIENT: ENVIRONMENTAL AND OPERATIONAL BENEFITS

A quieter propulsion system may seem like a secondary concern, but for certain segments of the market, underwater noise compliance is becoming a real consideration. PM machines operate with lower vibration and reduced noise compared to conventional propulsion systems, contributing to quieter vessels that comply with emerging regulations in sensitive marine environments.

This is an increasingly attractive benefit for operators serving environmentally regulated regions, such as the Baltic Sea or Alaskan waters – areas where underwater noise pollution is gaining regulatory attention.

For crews, this lower noise and vibration also improves onboard working conditions. This can positively impact seafarer retention and satisfaction – an often-overlooked operational benefit, especially at a time of a severe shortage of qualified personnel.

REDUNDANCY FOR RESILIENT BUNKER PLANNING

One of the biggest concerns in the transition to electric propulsion is reliability – particularly for large vessels with single shaft lines. PM machines address this with tandem motor configurations, where two machines share the propulsion load.

If one machine requires servicing, the second can maintain propulsion at reduced

For bunker suppliers, this means fewer emergency orders, more predictable delivery schedules and improved long-term customer relationships with shipowners who value reliable service.

REGULATORY READINESS: ANTICIPATING CARBON PRICING AND EEXI

The global bunker industry is increasingly influenced by carbon pricing mechanisms, regional environmental regulations and IMO frameworks like EEXI and CII. Vessels that burn less fuel per nautical mile – and emit fewer greenhouse gases per tonne-mile – will gain a competitive advantage in both compliance and operational flexibility.

PM machines fit neatly into this evolving regulatory framework, allowing owners to simultaneously cut fuel consumption and reduce carbon intensity. As emissions reporting becomes more transparent and penalties for inefficiency grow, vessels with PM machines will enjoy lower compliance costs and greater bunker procurement flexibility.

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This adaptability will be particularly important as alternative fuels scale up. PM machines' efficiency means they extract more propulsion power from each unit of fuel energy, helping offset the higher costs associated with low-carbon fuels. This efficiency advantage will make the transition to methanol, ammonia or hydrogen less financially painful – a major advantage for bunker buyers managing fleets in transition.

FUTURE-PROOFING THE FLEET: PM MACHINES AND THE BUNKERING ECOSYSTEM

The adoption of PM technology has profound implications for the bunkering supply chain. As shipowners prioritise efficiency, the focus of bunker procurement will shift away from price-per-tonne and towards lifecycle cost-per-mile.

Bunker suppliers who understand this shift – and can offer carbon-intensity indexed pricing, or customised fuel blends optimised for ultra-efficient engines – will be better positioned to build long-term partnerships with the next generation of shipowners.

In short, the transition to PM machines is not just about propulsion – it's about redefining the relationship between fuel, cost and compliance. It's a shift that directly links technology decisions at the engine-room level to global fuel trading and procurement strategies.

A DEFINING TECHNOLOGY FOR THE NEXT ERA OF BUNKERING

PM machines are set to become a defining technology in the future of global shipping. For shipowners, they represent lower fuel bills, simplified maintenance and easier regulatory compliance. For bunker suppliers, they represent a shift towards higher-quality, lower-carbon fuels and more sophisticated, data-driven procurement strategies.

The era of PM propulsion has arrived – and for every stakeholder in the bunker supply chain, understanding this technology is no longer optional. It's essential to ensuring relevance, profitability and long-term competitiveness in a rapidly changing maritime energy landscape.

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