

Introducing the Green List

Michele Witthaus takes us on a virtual ship tour, highlighting some of the environmentally friendly products and services that are helping ship operators achieve regulatory compliance and cost savings

SHIP DESIGN AND BUILD

Innovative technologies are driving visionary new ship designs that promise to improve environmental performance in style. For the 55,000gt Ecoship being built for Japan's Peace Boat organisation, that includes learning from nature: the ship features an aerodynamic hull inspired by the humpback whale. The non-toxic and anti-fouling coating of the hull is similar to fish skin. **Oliver Design** is responsible for designing the ship, which will feature retractable wind generators and photovoltaic sails, kinetic floors and a 6,000 square metre solar farm on the top deck. Construction is

taking place at Finnish shipbuilder Arctech's Helsinki yard.

Eco-friendly expeditions are in vogue and Ponant announced in December 2017 that its new expedition ship would be the world's first electric-LNG-powered luxury icebreaker. **Aker Arctic** and **Stirling Design International** worked together on the design and other partners in the build are **Wärtsilä** (dual-fuel diesel engines), **GTT** (LNG storage technology with 4,500 cubic metres optimised capacity) and **ABB** (Azipods).

Classification societies play an important role in ensuring that ground-breaking new ship designs meet required environmental

standards. **DNV-GL** offers a module-based structural analysis software package, **Nauticus Hull**, which provides tools for efficient hull design and verification. **RINA's** Green Plus notation has supported green innovation for over a decade, especially in the yacht expedition sector. Its expertise is increasingly applicable to expedition cruise operators seeking to take their ships into ever-more environmentally sensitive areas.

POWER AND PROPULSION

From hybrid solutions to wind power, fleet owners have never had more green options available to them. Hybrid and pure electric battery propulsion system design specialist **OSK ShipTech** has worked on a wide range of ro-ro and ro-pax vessels and helps clients with turnkey hybrid solutions for newbuilds and conversions. The company is working on designs for ships that feature a combination of zero emissions, maximum profitability and passenger comfort.

Corvus supplied an Energy Storage System for Scandlines' first ferries with battery hybrid propulsion. The advanced lithium polymer batteries are integrated with a **Siemens** converter system. The system is powered by four diesel gensets (one less than a non-hybrid design).

Award-winning ferry, *Vision of the Fjords*, brought zero-emission hybrid propulsion to the Norwegian fjords in

Image: Royal Caribbean International



ABB's Azipods improve vessel safety, energy efficiency, manoeuvrability and performance

2016. **ABB** supplied a compact, lightweight version of its Onboard DC Grid system to manage and control the energy flow between the diesel engine, propeller and charging station. The system transfers energy to the battery during charging and while the diesel engines are running.

Forward-looking operators are taking a bolder step with alternative technologies. **Norsepower's** Rotor Sail Solution uses the principles of the Flettner rotor – a spinning cylinder that uses the Magnus effect to harness wind power to propel a ship. The Rotor Sails can be used when the wind conditions are favourable, allowing the main engines to be throttled back, resulting in lower fuel use and reduced emissions without affecting speed and voyage time.

Cruise ships are exposed to intense sunshine in many of their itineraries. **Eco Marine Power** manufactures solar panels, including flexible ones, for cruise ships and ferries. The company's EnergySail, which combines the functions of sail and solar energy collector, is part of a solution that can also provide energy storage.

The Switch, a Yaskawa Corporation company, enables operators to take a proactive approach to a cleaner environment with its advanced permanent magnet shaft generator, electric propulsion and DC power distribution technology. These all provide high efficiency, especially when

running at partial loads. They also cut fuel consumption, lower emissions and increase flexibility, allowing compact and lightweight ship designs.

The growing availability of shore power (cold ironing) facilities is enabling operators to reduce fuel use at berth.

Royal Haskoning DHV's Cold Ironing service advises port operators and shipping lines on how best to connect ships to the public power grid from the landside while in port. Technical support is also available throughout the design, tender and construction phases.

Fuel cell technology from **Ballard Power Systems** is attracting interest from major companies such as Royal Caribbean Cruises Ltd. and ABB Marine. Ballard is engaged in a number of initiatives to provide zero-emission modular fuel cell solutions for the marine market.

EMISSIONS REDUCTION

Cruise and ferry companies are investing heavily in solutions that help them cut polluting emissions. **Wärtsilä** has supplied selective catalytic reduction systems for Virgin Voyages' first three cruise ships, while **Consilium** provides Continuous Emission Monitoring Systems to Carnival Cruise Line, including 18 back-up analysers. Denmark-based **CRR Maritime** delivers exhaust gas treatment filter technology

to help shipowners reduce exhaust gases from heavy fuel-burning engines, enabling compliance with International Maritime Organization regulations without converting to more expensive marine gas oil. The solution removes sulphur oxides and 99% of particulates.

Air lubrication for ship hulls is one of the tactics being used by cruise lines in the race to cut emissions. **Foreship's** under-hull air lubrication system for Royal Caribbean International's *Quantum of the Seas* features air bubbles that reduce drag and thus lower fuel consumption by up to 8%, according to initial estimates.

Other implementations of air lubrication technology are **Mitsubishi's** Air Lubrication System for AIDA Cruises ships built at the Mitsubishi Heavy Industries yard, and **Silverstream Technologies'** installation of its Silverstream air lubrication system on Norwegian Cruise Line's *Norwegian Bliss*.

Green coatings can improve environmental performance for cruise fleets. Paint manufacturer **Jotun's** sustainability programme, Jotun Green Steps, has given rise to products such as SeaLion Resilient, a biocide-free coating with low volatile organic compounds emissions. In 2017, Silversea chose **Hempel's** Hempaguard fouling defence coating for its new ship, *Silver Muse*, stating that the solution would help the line reduce carbon dioxide emissions.

Ponant's new expedition ship will be the world's first electric-LNG-powered luxury icebreaker





Scanship provides advanced wastewater purification system and sludge treatment systems for cruise ships

Emissions reduction is not only about mitigating the damage caused by burning polluting fuels. Initiatives that allow operators to use less fuel in the first place are also important. For example, **Climeon's** waste heat recovery systems allow cruise, ferry and cargo ships to transform waste heat into clean, sustainable electricity. This leads to a significant reduction in the amount of diesel used in generators, leading to lower fuel usage and lower sulphur emissions.

FUELS AND LUBRICANTS

LNG is currently the most popular of the low-emission fuels, although various operators are also looking to LPG (propane/butane), methanol and even hydrogen fuel cells to reduce their environmental impact. **Shell** will supply LNG for Carnival Cruise Line's two new ships due for delivery in 2020 and 2022. Towards the end of 2017, LNG tank system manufacturer **Gaztransport & Technigaz** won a contract to supply LNG tank to the Ponant expedition newbuild.

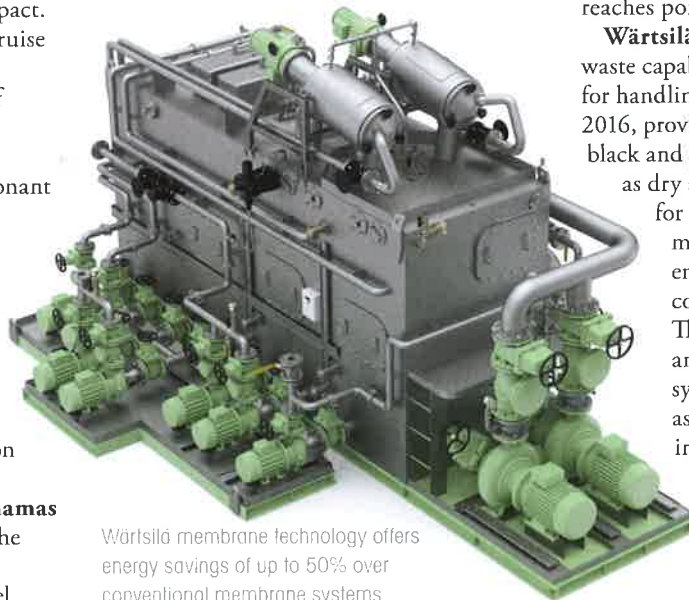
Good Fuels supplies biofuels for a range of industries, including marine. All of the company's biofuels are 'second-generation' in that they are from feedstock that is labelled waste or residue. Its sustainable marine gas oil and sustainable heavy fuel oil replacement achieve substantial emission reduction.

Cooking oil becomes biofuel at **Bahamas Waste's** biodiesel facility in Nassau. The company aims to convert one million gallons of cooking oil per year into fuel.

Lubricants are crucial to the smooth running of many ship systems and the US Environmental Protection Agency maintains a database of Environmentally Acceptable Lubricants (EALs). **Panolin** supplies shipping clients with environmentally considerate lubricants that are EAL-compliant and its Greenmarine range includes biodegradable hydraulic fluids that increase the service life of equipment.

MARINE OPERATIONS

While it's important for shipowners to invest in good equipment to reduce environmental impact, all of their best efforts can go to waste if they do not have effective policies in place. Full-service third-



Wärtsilä membrane technology offers energy savings of up to 50% over conventional membrane systems

party ship management company **Columbia Cruise Services** applies environmental policies across every department.

Reporting and analysis tools can help boost environmental performance. **Reygar's** BareFLEET solution remotely monitors fuel consumption, engine health, vibration, heave motion, weather and navigational information. Daily reports track vessel health, performance and navigational activity, along with fuel consumption and efficiency.

Eniram uses predictive analytics to enable operators to improve efficiency, combining data collected from vessels with plans and third-party information such as weather forecasting data.

Trelleborg's trim optimisation solutions provide continuous calculation of a ship's efficiency against the optimum trim for increased vessel efficiency. Meanwhile, **Rolls-Royce's** remote monitoring systems help its customers manage daily activities effectively and efficiently.

WASTE MANAGEMENT

Dealing responsibly with waste, from food to oils and sewage, is a constant challenge for fleet operators. **Ecoslops** provides waste recycling services to cruise vessels, enabling them to dispose of oil residues (also known as slops and sludges) in a cost-effective and sustainable way. The residues are transformed into reusable fuels and light bitumen. Added advantages for operators include transparency of the slops supply and disposal chain, as well as reduced fees paid to discharge the slops when the ship reaches port.

Wärtsilä supplemented its existing wet waste capabilities with a complete offering for handling dry waste in cruise ships in 2016, providing Saga Cruises with both black and grey wastewater disposal, as well as dry and food waste management for its new ship. Wärtsilä says its membrane technology offers energy savings of up to 50% over conventional membrane systems. The company also manufactures an incinerator with a wet de-ashing system that eliminates airborne ash in dry waste compartments, improving the quality of the air onboard. **Scanship** is providing an advanced wastewater purification system and sludge treatment system for Royal Caribbean International's