

Introducing the first Cruise & Ferry Green List

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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



ABB's Azipods improve vessel safety, energy efficiency, manoeuvrability and performance (Image:Royal Caribbean Cruises Ltd.)

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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 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.

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-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 fifth Oasis-class vessel, due to be delivered in 2021. This technology has been installed on two other Oasis-class ships.

French water treatment specialist BIO-SEA is well-placed to help shipowners meet the Ballast Water Treatment Convention standards. Its BIO-SEA UV water treatment system is now onboard over 100 ships and MSC Cruises is just one operator on its impressive client list.

Many cruise ships and ferries have eco-friendly vacuum toilets that reduce use. Jets vacuum sanitary systems use air to flush waste, cutting water usage by up to 90% and reducing the amount of sewage that needs to be stored and treated. Evac also supplies vacuum toilets for passenger ships and the company says that while traditional water systems use 8-10 litres of water per flush, its vacuum collection system uses just one litre.

Warewashing technology specialist Meiko's Waste Star SC is an integrated disposal system for organic kitchen waste that handles the large quantities of food waste produced on passenger ships. The automated, modular system collects and disposes of waste at source.

Dealing with the waste produced on ships is a major challenge – but what happens when the ship itself needs to be disposed of? Lloyd's Register offers a ship recycling consultancy service to shipowners whose older vessels have reached the end of their useful life.

HVAC systems

Modern HVAC systems balance demand for guest comfort with environmental sustainability. Koja Marine's cabin control and HVAC automation systems for cruise and ferry offers various energy saving features. Royal Caribbean International's new ships feature cabin lights and air conditioning that only come on when activated by the keycard. Halton Marine supplies maritime clients with 'chilled beam' HVAC technology for cooling, heating and ventilation, which it says lowers ventilation lifecycle costs and brings environmental benefits. A system of air curtains from German manufacturer Teddington has been used on AIDA ships to prevent loss of air-conditioned air when doors are opened onboard. Design-Aire Engineering, which provides waste water storage and distribution services, enables the reuse of water from condensation in air conditioning systems.

Galley, restaurant and laundry

Efficient galley systems can go a long way towards reducing a ship's environmental impact. Cooking equipment manufacturer MKN has an international Green Team that ensures its cooking equipment is sustainable. The company's combi steamers have achieved Energy Star certification for their energy efficiency. Almaco's Galley Energy Management system allows ship operators to control energy usage in the galley areas. The computerised system allows owners to save up to 25% of electrical power for the cooking equipment – more when combined with the ventilation system.

Alfa Laval supplied its MEP freshwater generator, as well as its PureBilge system and a 500m³/h PureBallast system to Norwegian Cruise Line's Norwegian Escape to boost her environmental performance. ACO Marine was contracted to manufacture and supply the complete galley water grease separation package for four AIDA ships. The work included ancillary lifting stations and pumps.

For passengers who like to dine on the go, Be Green Packaging manufactures high-quality compostable food packaging that is a sustainable alternative to plastic, paper and Styrofoam.

Laundry systems at sea must comply with requirements to reduce chemical use. The Electrolux Lagoon laundry system avoids the use of the environmentally hazardous chemical perchloroethylene (PERC). One of its passenger shipping clients is Saga Cruises, which banned PERC on its ships in 2012 due to its potentially hazardous effects.

Outfitting

Good ship design can reduce overall weight, and a lighter ship means lower fuel consumption. Composite specialist PE Composites and marine interior refurbishment firm Trimline has built a prototype lightweight composite cabin for the passenger shipping industry. It's easier to work with than cabins made of steel, and a larger number can fit in a smaller space (see article on page 164). Another company on a mission to reduce the weight of interior fittings is Metalcolour, whose lightweight sheet steel ceiling panels in its DOBEL Ocean Sky range are designed in an environmentally friendly manner to yield benefits including climate control and fire safety onboard.

High-tech decking solutions can save forests while providing enhanced durability. Bolidt's synthetic decking systems for passenger ships are designed for long-life and have high environmental ratings. The company uses IMO-approved materials that are hard-wearing, reducing waste.

Today's big cruise ships have multiple sets of elevators in frequent use. Kone Elevators contribute to energy savings onboard thanks to regenerative drive machinery that transfers electricity back to the ship's energy systems. The energy can then be used for other purposes such as lighting or ventilation. The elevators are also oil-free.

Interior design

The average cruise ship contains many metres of carpets that, if responsibly sourced, can boost the operator's environmental profile. Forbo Flooring System's Westbond carpet tiles are made from undyed wool, while more than 70% of the carpet backing is made from recycled content and 100% of its polyamide trim is recovered in the UK.

The environmental profile of furniture coverings is also an issue for ship designers wanting to specify green products. Sweden's Elmo Leather has pioneered an environmentally friendly tanning process with the aim of generating 'the cleanest waste water in the world'. After being used in the tanning process, local river water passes through a treatment plant for purification before being discharged back into the river or further purified to produce drinking water.

Window coatings can extend the lifespan of interiors. Royal Caribbean International installed Huper Optik's ceramic window tinting solution to improve energy efficiency on its ships by reducing the amount of solar heat and lowering the need for air conditioning. The tinted film reduced fading on carpets and upholstery (extending their life and reducing waste) and lowered surface temperatures onboard by more than 9°F.

Modern lighting systems on cruise ships and ferries take advantage of the possibilities offered by automation and motion activation to save energy. The widespread use of LED lighting also reduces energy use onboard. TVV Marine Lighting provides long-lasting LED lighting with low environmental impact to Royal Caribbean International and other cruise and ferry brands.

FZ Collection, based in New York, uses wood from controlled forests to create one-off furniture for hospitality and marine clients who want to minimise their environmental footprint without compromising on quality. The company heats its factory using wood scraps and also has a filtration system to remove sludge from water, which is then purified and recycled throughout the facility.

Entertainment systems

ABB provided robotics for the innovative Two70 entertainment space on Royal Caribbean International's Quantum ships, allowing for high-specification effects without the power drain and added weight that this kind of equipment needed in the past. Better environmental performance results from the reduced need for energy to deliver entertainment programmes.

Myrtha Pools supplies pools and outdoor wet play areas to several cruise lines. The company uses computational fluid dynamics – more often seen in energy-saving navigation systems – in the design phase of pools to facilitate distribution of disinfection products, lowering energy use and operating costs.

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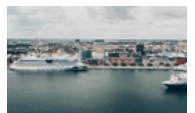
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