



Cruising ahead

The cruise sector is one of the front-runners in the field of marine energy efficiency. Its results are undeniably impressive, especially considering the energy-intensive nature of its vessels, compared with other ships such as bulk carriers.

Cruise lines experience the same key business drivers that encourage energy-saving initiatives in other vessel sectors — bunker prices and environmental legislation — but they are also subject to increasing customer and societal expectations. A highly visible industry and an optional form of shipping, cruise is an easy target for criticism.

Passengers increasingly expect cruise lines to demonstrate green credentials, and they seem willing to pay extra for good conscience. Conversely, a perception of poor environmental standards can be disastrous for a cruise company's brand equity. And although cruise can compare favorably with land-based vacationing on energy efficiency and emissions, especially for countries not signed up to the Kyoto Protocol, it can still make major improvements.

Lloyd's Register has suggested that with changes to financial parameters such as fuel prices, charging for CO₂ and a reduction in unit cost of new technologies, the cruise industry's potential energy savings can be up to 40 percent in the medium to long term.

Myriad solutions

As the number of cruise passengers continues to grow, cruise lines are investing in new technology to reduce their footprints. The industry's goal, backed by organizations like Cruise Lines International Association (CLIA), is to make cruise ships the most eco-friendly way to travel. Breakthrough ship design and technology is being incorporated in newbuildings and also to upgrade older ships.

Energy efficiency opportunities for a cruise ship are many. Jukka Ignatus, sales manager at ABB, suggests shipowners begin with the easiest measures to implement, such as dynamic trim optimization, power plant optimization and hull and propeller condition management plans. "Savings naturally depend on how efficiently the vessel has already been operated," Ignatus says. "But a fairly efficiently operated vessel can get energy savings of around 3 percent from trim (for propulsion energy in the speed range where dynamic trim has an effect, ie, over 10 knots), and a minimum 1.5 percent of total produced energy with power plant optimization. It is difficult to estimate for hull and propeller condition management, but considering hull fouling can cause added resistance up to 10 percent, we can safely say that combined savings are over 4 percent of total energy consumption."

CLIA estimates modern hull designs can give up to 15 percent energy savings and ecological hull coatings up to 5 percent. Reverse osmosis systems on RCL ships like *Oasis of the Seas* use only 35 percent of the electricity older vessels used to process potable water. The ship design and engineering company Foreship estimates that reducing sailing speed from 22 knots to 17 knots can reduce propulsion fuel consumption and emissions per nautical mile by almost 50 percent.

With advanced energy management systems becoming more common, more ships plugging into shore-side power and the advent of alternative fuels like liquefied natural gas (LNG), the energy efficiency trend seems set to continue.

As Tore Longva, business development manager at Det Norske Veritas, explained to *Generations*, "The cruise industry will be a forerunner for many new technologies that increase efficiency, especially power production, renewables and hybrid systems. We also expect increased efficiency through the combination and integration of onboard systems, such as waste heat recovery, HVAC (heating, ventilation and air conditioning) and power production. In addition, new types of fuel, such as natural gas and biofuel, will come into play."

Leading star

One of the cruise pioneers in energy efficiency, Star Cruises has spent eight years relentlessly seeking energy savings through a program that now features some 100 different measures.

Started in 2004, the energy efficiency program ranges from small measures with no costs attached to complex processes requiring investments of several hundred thousand dollars per vessel. Star Cruise's main goal has been to implement as many energy saving steps as possible, as long as the payback time is less than two years. Investments with a payback time of less than a year generally get an automatic go ahead. To date, the program has cut fuel consumption and created savings of more than \$7 million per year. *Generations* spoke to Mikael Mattsson, vice president of marine operations at Star Cruise, the man at the helm of most of its energy efficiency projects and innovations.

Q: What were the business drivers that led Star Cruise to develop its energy saving program?

A: It began with a cost-cutting exercise. Towards the end of the 1990s, the cruise segment was struggling and we were obliged to make some savings, not only on fuel but also across the board. This was compounded by fuel prices starting to rise in 2000 and really taking off in 2002.

Although energy efficiency and fuel savings always give positive environmental payoffs, this was not a major driver in Asia when we began the program. However, the cruise segment is naturally more sensitive about emissions and green thinking than other vessel segments, and I certainly expect emissions and environmental factors to become future business drivers in Asia too.

Q: Does the program reflect the company's business model and values?

A: Our motto is: "We take pride in our work and actively seek new ways of doing things better." One way to ensure this is to have very dedicated crews. We only employ the very best marine officers and we have an incremental salary system to help retain them – none of our captains and chief engineers has been with us for less than 12 years.



The combination of skills from experienced captains, chief engineers and electricians is important for achieving energy-efficient cruising. It is a complicated team task that involves all officers on board the vessels. Our crews are the major force in our energy efficiency efforts and have taken a lot of initiative with testing, observing and fine-tuning systems. On the other hand, we always put safety of passengers and crew ahead of fuel saving or cost cutting. I think we have one of the best safety track records in cruise, especially considering we are regularly in and out of the two busiest ports in the world, Singapore and Hong Kong.

Q: Has your across-the-board approach to energy saving started a cruise industry trend?

A: Energy efficiency is certainly a trend, but cruise lines differ considerably from region to region and therefore have different energy efficiency challenges and strategies. For example, in the Asia-Pacific, our itineraries differ from those of cruise companies in the United States, Europe and elsewhere. We do a lot of short cruises and shorter distances between ports and this means many varying speed profiles, including slow cruising, rifting and anchorage. Itinerary planning is an important fuel-saving measure where we have to strike a balance with passengers' need for enough time in ports, so it involves close cooperation between marine operations and sales and marketing staff.

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Q: What are the more than 100 energy-saving measures?

A: There are many opportunities to save, especially on older vessels. Apart from frequency converters on pumps and fans – which we have installed throughout the fleet and can reduce energy consumption by up to 60 percent – we are talking about many internal processes.

The key element is HVAC (heating, ventilation and air conditioning). All our newer vessels have automatic HVAC systems, and we are automating our older vessels to correlate HVAC with air conditioning compressors and chiller and cooling water pumps.

The effects of trim optimization and underwater hull optimization on fuel consumption are well-known, but less well-known is the effect on engine loads. If you create a better hull shape and reduce drag it can save around 10 percent on fuel, but it also means 10 percent less load on the engines. A reduced base load means that you can switch down one engine and run two engines on full load, where they are most efficient, instead of three engines on 60 percent load.

This is where the big gains are. You can always save 50 kilowatts here and 50 kilowatts there, but if you can take one engine offline it can lower the average power consumption of a vessel by 10 to 15 percent.

Our 75,000-ton *SuperStar Virgo* is a good example. Her engines were 12 MW each. When she came to

Asia, they were running at 10.5-11 MW, with full air conditioning and everything. After all the fuel-saving initiatives were done, including the HVAC scheduling, we were down to 8 megawatts. The measures included fuel optimization and dynamic trim tools as decision-support for the bridge crew, an anti-fouling system and improving the hull hydrodynamics.

Before considering dry-docking any vessel from now on we will do underwater CFD (computational fluid dynamics) hull simulation to see if we can improve hull performance – establish stern and bow thrusters, pockets and tunnels, eventually maybe even duck-tails. On *Virgo* we modified the stabilizer pocket and achieved around 3 percent fuel savings at some speed profiles. Of course, adding a ducktail to an existing vessel is an expensive option, but we are running a trial to assess the potential savings from the improved hull performance. We believe *Virgo* is now close to optimal energy efficiency. At the next dry-docking, we will take the final step by installing new propulsion enhancement.

Energy for propulsion is a major cost in cruise. For propulsion efficiency and maneuverability there is nothing that can compete with Azipods. They are excellent fuel-saving devices due to the hydrodynamics of the propeller flow, and we will use them on our next newbuilding.

Q: How do you decide which energy-saving measures to prioritise?

A: I have to estimate the savings from any automation or efficiency system. However, in choosing a system, what is more important than its cost is its performance – including how it interfaces with other onboard systems – as well as the existence of a good service organization in Asia.

We have installed NAPA Power routing systems on *Virgo* and *Libra* for energy efficiency and will soon have three more optimization programs running for trim optimization and stabilizer control. Trim optimization systems are difficult to implement across the fleet because they are difficult to interface with old equipment on older vessels, and this becomes costly and delivers inaccurate results. On older vessels, it is better to use a less advanced system – potential savings can be less but problems are less too so we save time and effort.

On a new vessel, it is much easier to implement an advanced system like EMMA™, the ABB one. Being plug and play, these systems get you up and running quickly and allow you to show crew accurate results, so they quickly feel confident about using them.

Q: Have you investigated new energy sources?

A: Yes, we are looking into efficiency gains from alternative fuels. We are participating in a workshop in Singapore on a small-scale LNG operation where LNG will be used as fuel for conventional ships, including passenger vessels. Led by Det Norske Veritas and with participation from a number of other major industry players, we are discussing topics like LNG bunkering – not only for LNG carriers but also for commercial shipping. At the moment there are no LNG bunkering stations in Southeast Asia. Singapore (SLNG) will be the first station for bunkering, with facilities planned to be in operation by late 2013.

We believe in LNG as the future propulsion fuel for the shipping industry, but there is still a long way to go before it can guarantee full safety for passengers and crew. The biggest obstacle is the bunkering sequence, which can be very complicated.

Q: What other new energy-saving measures do you have on your drawing board?

A: I'm evaluating retrofit replacements of conventional diesel engines with common rails to improve efficiency. We will probably commence a pilot project with two engines in February 2013.



Mikael Mattsson is AVP Marine Operation at Star Cruises and a specialist in marine new buildings, retrofits, refurbishment and electrical projects. He is passionate about marine industry efficiency and has managed most of Star's energy efficiency projects and innovations.

Star Cruises

Star Cruises, the world's third largest cruise company, has led cruise development in the Asia-Pacific region, where it operates seven vessels between the ports of Singapore, Port Klang (Malaysia) and Hong Kong. Star caters to Asian passengers as well as to North Americans, Europeans and Australians interested in Asian destinations. Its energy saving program has given Star Cruises a best-in-class status in the cruise industry.

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Photos and illustrations: Star Cruises