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WHAT CAN BE DONE TO SAVE FUEL? (Published in Cruise Industry News)

Energy consumption of a cruise ship depends on several factors of which the most important are size, speed and operational profile. For a modern post-Panamax vessel the annual energy consumption can be approximately 200 GWh (gigawatt hours), or when converted into heavy fuel oil, around 40,000 tons. With today's fuel prices this means more than 25 million USD per year or roughly 350 USD per cabin per week.

These are high figures, and the situation will only get more difficult: fuel prices continue to increase, while new emission legislation will also have its effect on fuel cost. Already now there are locations where ships are forced to use marine gas oil instead of heavy fuel oil. Commencing 2010 cruise ships need to use marine gas oil while in European ports and global sulfur limits are already planned. It is not impossible to imagine quadrupling fuel costs in the near future, and thus drastic fuel saving measures will be needed to ensure that cruising remains an affordable holiday option.

Energy consumption of a cruise ship can be divided into two parts: propulsion and hotel load, each consuming roughly half of the total energy demand. Based on the above example, one percent reduction in either propulsion or hotel load will save more than 100,000 USD per year.

PROPULSION LOAD

Considering propulsion power the new ships are significantly more efficient than the older vessels: a ship considered hydrodynamically excellent ten years ago would today need 10% less propulsion power for the same speed, but in case of a bad example, the difference could be more than 30%. The biggest factor in this development has been the use of CFD-software (Computational Fluid Dynamics), which has made efficient hull form optimization possible. Hull form optimization with CFD-calculations is today a standard on any newbuilding, but ship owner has to be aware of what is possible and be able to negotiate a challenging enough performance specification for the vessel. Sometimes a bonus arrangement can be used to make sure that exceeding specification requirements benefits both parties.

Other developments reducing propulsion load area are the new low resistance hull paints, which can give substantial saving over the traditional antifouling paints. Naturally pods themselves bring some improvement, but more importantly they also enable more freedom to design efficient hull form.

Even if possibilities are much more limited in case of old ships, in some cases significant benefits can be gained by a hydrodynamic conversion of limited scale: examples are introduction of ducktail or interceptor to improve the aft ship or modification of bulbous bow, but even smaller modifications such as adding scallop fairings for fin stabilizers and bow thrusters will bring savings.

The most efficient way to save fuel consumption for propulsion is to reduce the vessel speed: reduction of cruising speed by one knot usually means more than 10% reduction in propulsion power. If the itinerary can be modified so that instead of a high speed leg there is a slow speed day at sea, the saving can be annually more than one million dollars. Similarly the operation principles can produce savings: running engines on optimum load, ballasting the vessel correctly, avoiding excessive speeds to “guarantee” on time arrival and using fin stabilizers only when needed are all important practices.

HOTEL LOAD

Considering energy consumption hotel load is as important as propulsion load. The biggest savings can be gained by concentrating on the biggest consumers: on a cruise ship the air conditioning typically consumes approximately half of the total hotel load. Other big consumers are power plant auxiliaries, lighting and galley equipment.

One very efficient way to save energy used for air conditioning is to reduce the amount of exterior window surfaces. Large sun deck overhangs are also beneficial, as they shadow the windows and balconies below. Cooling demand can also be reduced by itinerary planning: traveling towards or away from sun is much better than letting sun heat up the side of the ship. By cooling rooms only when required sounds logical, but on too many ships the air conditioning is running with same configuration whether the public space is full or empty. Increasing the dining room temperature for night and lowering it again before the passengers arrive the next day is an easy way to improve consumption, but still not a standard practice.

There is no consensus on the best possible air conditioning system, but for energy saving point of view the most efficient way is to minimize the amount of fresh air intake and thus the energy needed for cooling and humidity removal. This is one reason for the popularity of the fan coils on almost all new ships, but there are also better solutions than placing literally thousands of fan coils, each with own small fan, motor and cooling coil, all over the ship.

Energy saving and LED lights, frequency controlled pumps and fans and new automated control systems provide possibilities to save energy, but new technology can also increase energy consumption: examples of this are the increased amounts of computers and LCD-screens on ship, which all not only use electricity but also produce heat. It also good to remember that all new systems which are needed to reduce emission levels but need energy to work, almost always increase CO_2 emissions: examples of these are the ballast water treatment systems, some advanced waste water treatment systems, exhaust gas scrubbers and catalyzers. If these new systems increase the weight of the ship, more energy will be needed for propulsion as well.

HEAT ENERGY

Heat is required on cruise ships, for example, for air conditioning, fresh water production and heating, fuel oil heating, galleys and laundries. Heat is recovered from exhaust

gases and from engine cooling water, but when this is not adequate – which is typically always except at higher cruising speeds - oil fired boilers need to be operated. This means that saving and recovering heat energy is as important as saving electricity. A good example of saving heat energy is to reduce fresh water consumption and thus the amount of heat needed in fresh water generators.

Cleaner fuels required in the future, even if more expensive, save energy: today's heavy fuel oil needs to be heated in tanks and fuel systems and its high sulfur contents mean that only portion of the exhaust gas energy can be recovered without risk of corrosion in exhaust gas system. Cleaner fuel would then also mean that amount of recoverable heat can increase significantly, opening maybe possibilities to new systems on ships: one is to replace the refrigeration compressors with absorption chillers, which would reduce the hotel load significantly. Already now covering part of the cooling load by absorption chillers could be an alternative.

For a newbuilding the simplest way to save energy is to make sure that all the easily available heat is recovered: the most important issues in this respect are properly dimensioned exhaust gas boilers and efficient fresh water generators. Being more expensive than the "shipyard standard", the owner needs to know what is possible and prepare own economy calculations.

CURRENT SHIPS AND FUTURE NEWBUILDINGS

On existing ships the easiest way to save energy is to maintain and operate the ship properly and train the crew to save energy. When these things are in order, energy saving conversions and modifications could be considered.

For new ships all options are available. The hull form can be optimized and the large window areas minimized, providing the owner and architects understand that compromises in ship's outlook are needed to achieve the best results. When choosing the equipment, top priority should be on energy saving and energy recovery aspects; as this usually also means more expensive equipment, the owner has to be ready to spend more on the ship to gain savings in the long run. Sometimes some new good technology is not utilized because it has not yet been used on ship – maybe higher fuel prices will help to take the risk in these situations.

Energy saving on cruise ships, even if all today's possibilities are utilized, still has quite limited potential. As an example, replacing the propulsion plant by sails would only half the annual fuel costs. Instead of sails, maybe a more realistic solution would be cruises where the ship would travel only a short distance to the sea and dock into special buoys which can provide shore based, cheaper electricity. Whether or not this will be acceptable to passengers, is another question, but the new large ships with almost unlimited onboard entertainment options are better prepared for this kind of operation.

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