Efficient Design on Ferries

Introduction

Ferries come in many forms, from small road ferries to big cruise ferries. They may operate between two ports only, or they may visit several ports, and ambient conditions vary from tropical conditions to arctic conditions. Each case needs to be studied in detail in order to create the most efficient ship for the intended operation.

Concept

Efficiency starts from the concept phase.
In general it can be stated that harbour time should to be minimized. This enables reduction of speed in transit and thus reduces energy consumption. This of course means a smaller fuel bill, but in addition allows a reduced installed power and lower investment costs as well.
Therefore an efficient flow during loading and unloading is essential for ferry operation. Many things are taking place simultaneously, and these should not interfere with one another, as disturbances tend to escalate. The use of “lower hold” for cargo should be carefully evaluated (as it may add considerable complexity to the logistics).
Money spent in faster deck equipment will save at least equal amount of money in machinery and fuel.

Machinery Concept

Operation profile is needed for the machinery feasibility studies.
Design needs to be optimized for the intended operation, instead of a single speed.
Desired level of redundancy (beyond the rules) and operational preferences need to be defined at an early stage and these requirements need to be taken into account in the evaluation process of machinery alternatives.
In recent years, most MT ferry projects have ended up with Diesel-Electrical configurations. Even in cases with quite simple operation profiles, where theoretically a mechanical alternative might have been slightly more economical, the DE alternative has been preferred, because of its flexibility, reliability and ease of operation when manoeuvring. Huge thrusters, in relation to normal domestic load, tend to create challenges for mechanical installations with CPPs. Especially this is the case with cruise ferries with high comfort requirements, during harbour visits noise and vibration should remain at a low level.

Hydrodynamics

Contractual speed should be the real life service speed of the intended operation.
Traditional concept of “trial speed”, with all kinds of inbuilt reserves, will not give an optimal efficiency in normal operation. In recent MT sales project we have had contractual speed figure down to 57% of MSP.
Through the use of advanced CFD-tools, it is nowadays possible to design efficient hull forms with low L/B-ratios. In general, a low L/B- ratio allows the ship to be built lighter (with equal volume), and increased width allows more lanes on cargo decks. In the case

fast ferries L/B-ratio has come down from 8.4 (Finnjet, delivered 1977) to 7.8 (Superfast III, delivered 1998) and now even to 6.9 (NB-1391 for Tallink, to be delivered 2017).
Viscous flow CFD-tools are available today and extensively used for design and fine tuning. The model tests are used to final verification of resistance and cavitation behaviour estimation.

Hotel load

In addition to machinery auxiliaries, the biggest consumers are air conditioning, ventilation, lighting, provision cooling and food preparation.
A lot of small savings can be achieved here and there, in addition to improved equipment, mostly due to operational optimization, like demand-based or scheduled operation.

Waste heat recovery WHR

Less than half of the energy content of fuel is transformed into mechanical energy, the rest becomes heat. This energy, in the form of heat, is valuable energy and should be used in various ships' systems, especially instead of running auxiliary boilers.
The heat energy at a high temperature, such as hot steam from exhaust gas economizers, is rather easy to utilize in various systems.
Unfortunately a lot of the surplus heat is at a lower temperature and is more challenging to utilize.
HT water can be used for fresh water production, fresh water heating, heating of accommodation, pool heating and stand-by ME pre-heating.
LT contains also plenty of heat energy, which is unfortunately even more difficult to utilize.
Also, quite often the challenge is that supply and demand does not occur simultaneously. This heat energy should be stored for later use or transformed into electricity.
Today, if all proven means of WHR are utilized, there still will be excess heat that must be dumped. There are already technologies, to transform this excess heat into electricity, available and economically viable, and more in the near future.
There are already technologies available and economically viable, to transform this excess heat into electricity, and more possibilities are foreseen in the near future.