

Lifetime costs and emissions are important in ship design

Life cycle cost analysis (LCC) and life cycle assessment (LCA) are tools to evaluate the total cost of acquiring and owning a vessel. In addition to assessing costs, the environmental impact of design selections and benefits from new energy-efficiency solutions are considered.

From a shipowner's point of view, acquiring a ship is a significant investment. However, acquisition cost alone does not reflect the full expense of owning, using and maintaining the ship. Calculating the life cycle costs, or LCC, helps to evaluate the economic aspect of a vessel's entire lifetime, from fuel for operations to maintenance costs.

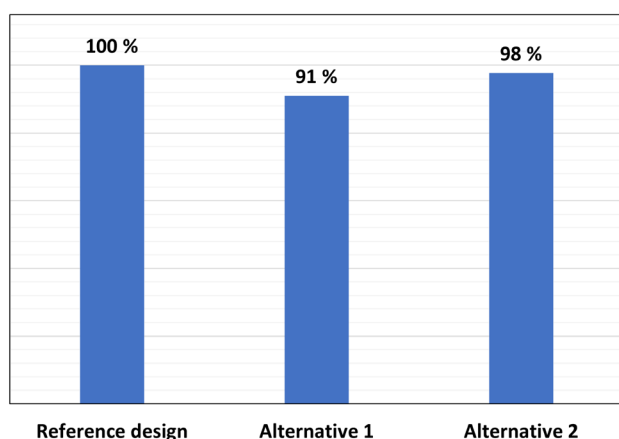
"It is the sum of the acquisition cost, the support cost and the operational cost," says Cayetana Ruiz de Almiron, Head of Consultancy and Technology Development at Aker Arctic.

Evaluating alternatives

An LCC analysis is usually a comparison of two or more alternatives, against a baseline or a reference case.

"The main target is to give the client real values to make the decision regarding which design alternative would be most optimal for the requirements," continues project engineer Jesse Lehtonen who does machinery simulations based on the design, and calculates fuel consumption, emissions and other relevant values based on the operational profile.

Energy consumption - different design solutions



Comparing the energy consumption of a vessel to a reference design gives an understanding of which one is the most efficient.

If an operational profile is not available, data from a reference vessel can be modified and scaled accordingly in order to estimate fuel use in similar operations.

"With statistical data, separate calculations for easy, moderate and severe winters can also be made, in addition to looking at how often such winter types may occur during the expected lifetime," Lehtonen explains.

The generated values are then used to determine the life cycle cost and life cycle assessment.

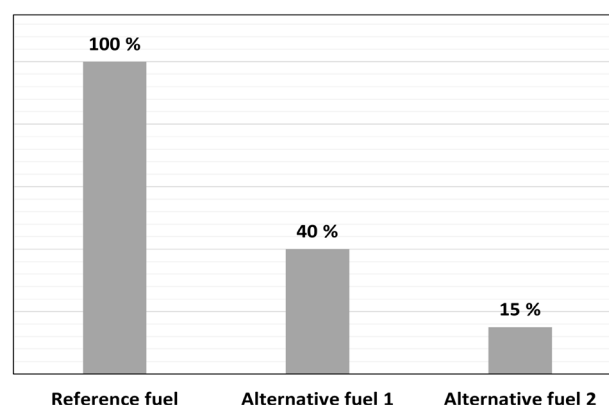
"The LCC and LCA studies provide the information about the cost and environmental impact in the long run for each alternative design solution," Ruiz de Almiron says. "Consequently, they are easy to compare."

Carbon footprint calculations

Fuel consumption values are also used in the life cycle assessment (LCA), which shows the amount of emissions generated during a vessel's lifetime.

"With the current trend moving towards greener technology and lower emissions, the main focus is on the carbon footprint," Ruiz de Almiron says. "Other emissions can also be calculated, depending on the customer needs, but presently attention is on the CO₂ equivalent."

Annual emissions of CO₂e - different fuels

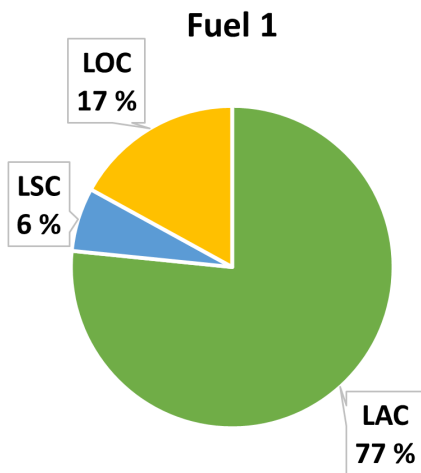


CO₂ emissions depend on the type of fuel. Emissions can be reduced considerably by selecting an alternative fuel.

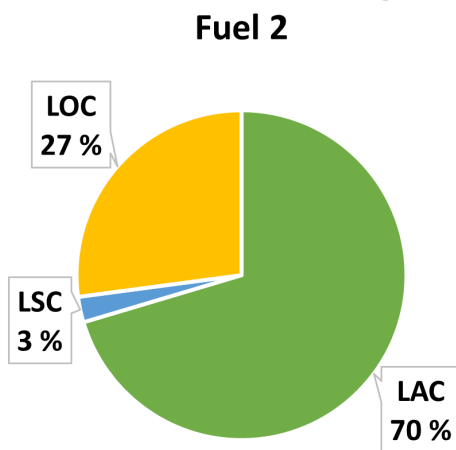
Interest in these calculations is clearly growing, showing that customers are increasingly considering emissions in ship design. Initially, it was related to governmental projects, but now the commercial sector is heading in the same direction.

"There is a rising global demand," Ruiz de Almiron adds.

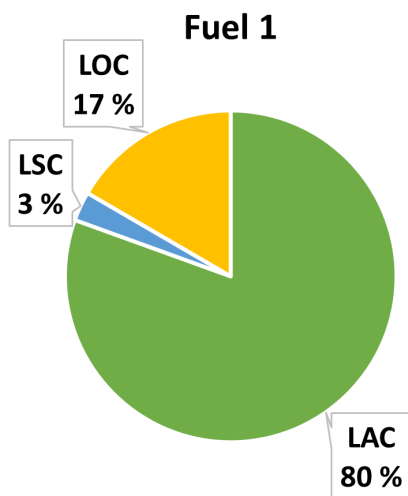
LCC - Reference design -



LCC - Alternative design -



LCC - Alternative design -



The acquisition cost (LAC) is the biggest driver of total LCC over 50 years in every case. Life Operation Cost (LOC) depends mainly on the fuel price. Life Support Cost (LSC) represents a very small share of total LCC.

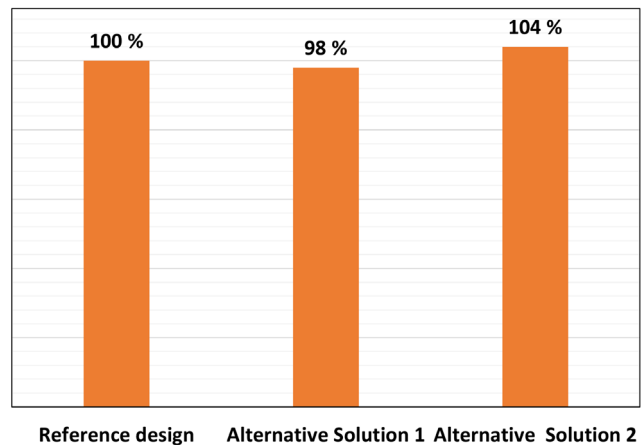
Parallel with the design

The biggest decisions in a project are made in the beginning. Having the results from LCC and LCA greatly assist in decision-making, once the main parameters are clear. "LCC can, for instance, help to find out which propulsion configuration would be best from a life cycle cost point of view, or to compare two design options," Lehtonen says.

When the design is refined and goes further into detail, the calculations can be updated with new simulations, as modifications in the design naturally have an impact on the costs.

During the design process, questions regarding new technology can be dealt with thanks to the help of LCC and LCA. For instance, the advantages and cost

Life Cycle Cost



The comparison of the total LCC supports investment decisions for different solutions, as the economic impact over the whole life cycle of a given solution can be quantified.

of installing an energy storage system, or the use of alternative fuels.

"With these tools we can actually evaluate the benefits and costs of rapidly developing energy-efficiency solutions, which are not standard features currently," Lehtonen underlines.

Addressing open questions

The LCC and LCA service is highly recommended when there are open design questions, such as the selection of characteristics and how to improve energy-efficiency.

"In our own design projects, it is easy to get all the required information from our colleagues, but calculations can also be done to evaluate external designs," Ruiz de Almiron says. ■