

## Summary

A new and first-time study of the historical development of the efficiency of new ships shows that, in fact, the efficiency of new ships has actually deteriorated since 1990 by 10% on average. This finding is relevant in three ways. First, it once more demonstrates the failure of market forces to reduce ship and shipping emissions and emphasizes the need for regulation.

More specifically, it demonstrates the need for tighter 2020 standards for new ships. The International Maritime Organisation (IMO) is currently reviewing whether the efficiency standard for new ships in 2020 is still appropriate. This study shows that the current standard, a 20% improvement of efficiency compared with the 1999-2008 average, does little more than bringing the efficiency of new ships in 2020 back to levels seen around 1990. This would imply a 30-year stagnation of efficiency improvement, meaning that reducing shipping volumes would be the only avenue for net reductions of emissions.

Thirdly, the evident deterioration in average ship efficiency over the past decade and the expected 30-year standstill between 1990 and 2020 stands in marked contrast to other transport modes. New cars, for instance, are subject to legislation and currently are becoming around 2% more fuel efficient per year and are expected to use around 30% less fuel in 2020 than they did in 1990.

### **Acceptable in the 80s... and 90s but downhill after**

A study by CE Delft for T&E and Seas at Risk analysed the development of the design efficiency of new ships (as measured by their efficiency indicator values (EIV)) built over the last 50 years. The analysis shows that ships built in the 1970s were characterised by deteriorating or constantly poor design efficiency. Design efficiency improved considerably for all ship types and all size categories in the 1980s, reaching an optimum in the 1990s. However, in the 2000s, design efficiency deteriorated again, wiping out much of the gains of the 1980s. This analysis suggests that significant swings in design efficiency have occurred within a relatively short time frame.

The study shows very large variations in design efficiency between the best and worst years for individual ship types. For instance, the best-designed bulkers built around 1990 were some 14% better than those built today. For tankers the best designs for new builds around 1988 were 10% better than those built today. The difference for container ships was far greater. Those built in 1985 were about 25% better than those built in 2013. However, this

does not reflect the large reductions in CO<sub>2</sub>/TEU/mile for containers due to increasing ship size and improving engine efficiency over this period.

### **Are IMO's design efficiency standards fit for purpose?**

There is a growing interest in the fuel efficiency of ships because of rising oil prices, climate change, and energy security issues. From 2013, new ships need to meet the IMO's Energy Efficiency Design Index (EEDI) targets, which become more stringent over time. Currently, the IMO is reviewing these targets and one of the main questions being addressed is their effectiveness and stringency.

### **Factors affecting ship efficiency**

Depending on the ship type or size, this study shows that ship design efficiency improved in the decade of the 1980s by 22% to 28%. This trend seems to have been purely market driven, principally by a combination of sharply increasing oil prices and constant or low freight rates. Looking more deeply at the factors that contributed to improvements in the 1980s shows that in some, but not all cases, efficiency improvements were brought about by reductions in design speed. In other cases, the size of the ships has increased. However, these two developments cannot fully explain the improvements. In many cases, the evidence points to improvements in hull design and propulsion efficiency as having contributed significantly to efficiency improvements. Likewise, the deterioration after the 1990s appears to be due, at least in part, to designs in which cargo capacity or capital costs were given more importance than fuel efficiency. This is a potentially important finding given current lower oil prices.

### **More stringent design efficiency standards within reach**

The relevance of this study for the review of the IMO's design efficiency standards is that it suggests that ships can improve their design efficiency by 5% to 15% on average just by going back to 1990s designs. Analysis of the design efficiency of ships that have entered the fleet since 2009 would appear to show this has in fact been happening. And since hull, rudder and propeller and engine designs have likely improved in the past 25 years because of technological progress, such as the development of computational fluid dynamics, much larger efficiency improvements are probably within reach. Lower design speeds could improve design efficiencies even more where appropriate.

### **Further information**

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