Efficient propulsion: the Triple-E's 'twin-skeg'

The world's largest container vessel does not require a gas guzzling monster in its engine room to move it through the water. In fact, the Triple-E's 'twin skeg' propulsion system (two-engine, two-propeller) is central to the vessel's world record efficiency.

To build the world's largest and most efficient vessel, Maersk Line needed to custom design a propulsion system that would be both powerful enough to move the vessel, but with maximum efficiency to be worthy of the Es in its name: Economies of scale, Energy efficient and Environmentally improved.

For starters, the top speed of the Triple-E was capped at 23 knots, two knots lower than Emma Mærsk's top speed. This meant a power requirement of only 65-70 megawatts compared to Emma's 80 megawatts – a 19 percent reduction.

A slower max speed also enabled Maersk Line to consider engines that could operate at slower revolutions – 'ultra-long stroke'– which provides the greatest fuel efficiency. To retain the efficiency created by the slower revolutions of an ultra-long stroke engine requires a larger propeller diameter. However, the size of the propeller is limited by the dimensions of the vessel and the available space beneath the keel.

To mitigate these restrictions and achieve the desired efficiency, Maersk Line research determined that a two engine/two propeller 'twin skeg' system was superior to the one engine/propeller setup.

The Triple-E's two propellers are 9.8 metres in diameter with 4 blades each, compared to Emma's single propeller, which is 9.6 metres in diameter with 6 blades. The combined diameter of the propellers provides greater pushing power in the water and the fewer number of blades creates less resistance.

All together, the Triple-E's twin-skeg propulsion system consumes approximately 4 percent less energy than Emma Mærsk's single engine/single propeller propulsion system.

FACTS >>>

MAERSK LINE

FACTS: Triple-E's twin skeg propulsion system

- Overall, the Triple-E will have approximately 35 percent better fuel efficiency compared to a standard 13,100 TEU container ship. This is calculated per moved container – the total energy consumption of the vessel divided by the number of containers it transports

- The Triple-E container vessel's 16 percent additional capacity over and above that which is carried by the Emma Mærsk class of ships is not matched by a requirement for additional engine power

- The Triple-E is designed for lower speeds. That means that the essential challenge for the vessel is to obtain the lowest number of engine revolutions with the largest possible propeller diameter using the fewest blades to therefore achieve best overall efficiency and lowest fuel consumption

- Achieving the desired efficiency with a single propeller is restricted by the draught of the vessel and available space beneath the keel. In order to overcome this, Maersk Line will introduce the twin propeller solution which will meet all size restrictions while offering the required large surface area

- The twin propeller solution can be more energy efficient than one because of the vessel's slower average speed. The idea is to have as much propeller diameter as possible to match the low number of engine revolutions

- This requires a special engine, a so-called ultra long stroke engine. This MAN Diesel engine operates with a lower number of revolutions compared to a traditional engine
- Having two propellsers will require two of these engines each with the following specifications:

  - Weight: 910 metric tonnes
  - Horsepower: 43,000
  - Consumption: 168 grams bunker oil per Kilowatt hour produced

- Fewer propeller blades on the Triple-E (four compared to six on Emma Mærsk) means less wetted surface and thereby lower resistance. The Emma class is optimised for higher speeds (25 knots) and higher number of revolutions where the six blades are more optimal

- A larger combine propeller diameter on the Triple-E (two 9.8 metre propellers (estimate) compared to Emma Mærsk's single 9.6 metre propeller) means that it can move more water. And with fewer blades, it does so with less resistance which means betters fuel efficiency.