Fuel saving is about more than slow steaming

Fuel saving measures tend to focus on engines, propellers, hull design, trim optimising and weather routing, but managed cargo heating can save thousands of dollars, says **Dimitri Ivanov***

The extent to which cargo heating can contribute to fuel saving is often overlooked by tanker operators. By using scheduling software to optimise the fuel oil that they use for heating crude cargoes, consumption can be reduced and the requirements of IMO's ship energy efficiency management plan (SEEMP) met.

Let us take a closer look at the process to understand the costs involved and where any savings can be made. Our base case will be a 104,000 dwt crude/product tanker on a 20 day voyage. The cargo volume of the tanker is 124,408.6 m^3 and the ambient conditions are: air temperature +5°C; sea water temperature +3 °C; wind speed 2-3 knots; and finally sea state is 2-3.

The cargo in all the tanks is IFO380 loaded at a temperature of 60°C. The voyage instructions are to maintain the cargo temperature at not less than 40°C and ensure it is discharged at 60°C.

To heat the cargo from 40°C to 60°C in 96 hours requires 1,588 MWt of heat energy. In other words, cargo heating will require the boilers to run with a steam capacity of 27 t/h to produce steam of 150°C at 7-8 bar pressure. Modern marine steam boilers consume 1k of fuel to produce 13k of steam. Over a 24 hour period cargo heating at this rate will burn almost 50 tons of fuel, which will cost the owner between US$30,000 and US$50,000 per day depending on the fuel used, where high sulphur is US$600/ton and low sulphur is US$1,000.

During the same voyage the main engine on board the ship in this example is running at 70 per cent mcr consuming about 40 tons of fuel per day. In other words the cost of cargo heating is at least equal to, if not greater than, the cost of propulsion.

One of the most common misconceptions is that there is nothing that can be done about the amount of energy, and therefore money, that must be spent on cargo heating. Staying with the 104,000 dwt tanker example, there are three principle methods for managing cargo temperature.

Dimitri Ivanov: Scheduling software supports regulatory compliance and fuel savings

With exactly the same ambient conditions those three scenarios (plans) will require different heat energy, and therefore different fuel and cost. The following calculation sets out the energy that is used:

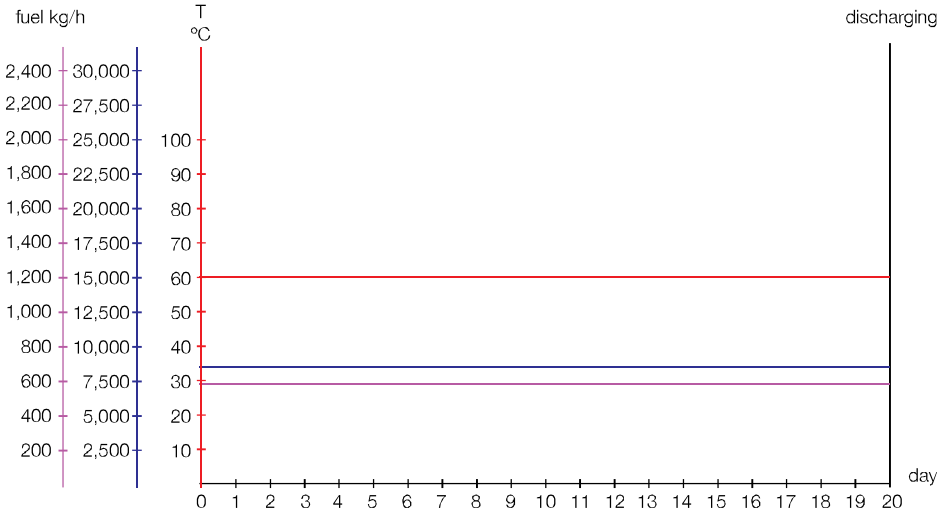
It is obvious that plan two is the most cost effective. The difficulty is in knowing when to start heating in order to have the correct discharge temperature and to expend as little energy as possible

We should not forget that the cost of the heat energy on board can vary by 100 per cent, depending on what type of fuel (high sulphur or low sulphur) is used. This means that plan 3 can be an advantage in some cases; for example, when high sulphur can be used before coming into emission control area (ECA) waters and low sulphur must be used for the last days only.

Another factor is boiler efficiency, which can vary according to the boiler load. Efficiency can be very poor at partial load below a certain level, so this factor must be taken into account. In certain cases it could be more efficient to follow plan 2 or plan 3 and generate more heat than the minimum demand required.

Of course, the calculations will be different for every individual ship, and for every individual voyage in terms of the ambient conditions and the properties of a particular cargo. The task, therefore, is to provide the owner with a tool which will help to find the

1. Keep the loading temperature at 60°C during the entire voyage until discharging (plan 1)



parameter	unit	plan 1	plan 2	plan 3
energy	MWt	2,217	1,791	1,894
steam	ton	3,696	2,985	3,158
fuel	ton	284	229	243

optimum scenario for each case.

Our new product is a cargo heating management software system called HeatPlan. It can be used on board a vessel or ashore and provides prediction, simulation and cargo heating optimisation. This not only results in significant cost savings but also improves general voyage planning in terms of fuel optimising, becoming an integral part of the vessel's SEEMP.

The system is based on a dynamic heat transfer model of each individual ship.

The model is based on ship drawings and is verified by statistics from the first voyage with cargo heating, in the same way as loading computer software is verified by inclination tests.

Once information has been submitted about the weather and cargo properties, the system suggests the most economical plan, setting out how much steam should be used for each tank, each day, to get the best result.

The accuracy of the initial plan depends on the accuracy of the weather forecast. The system will correct the plan on a daily basis as new weather information is submitted. This means that the plan becomes more and more accurate as it approaches the moment when cargo heating should be started.

By following the plan the owner should never start heating too early and should never use more fuel than necessary. Furthermore, he will always be on time with the correct cargo temperature for discharge.

The software package includes a simulation mode, to help the owner to optimise fuel consumption for cargo heating. In the simulation mode the operator can insert information about the amount of steam to be supplied to the tanks for the heating. The system automatically shows how cargo temperature will change. The efficiency of the boiler can also be set and this factor will be taken into account by the system in its calculation of fuel consumption.

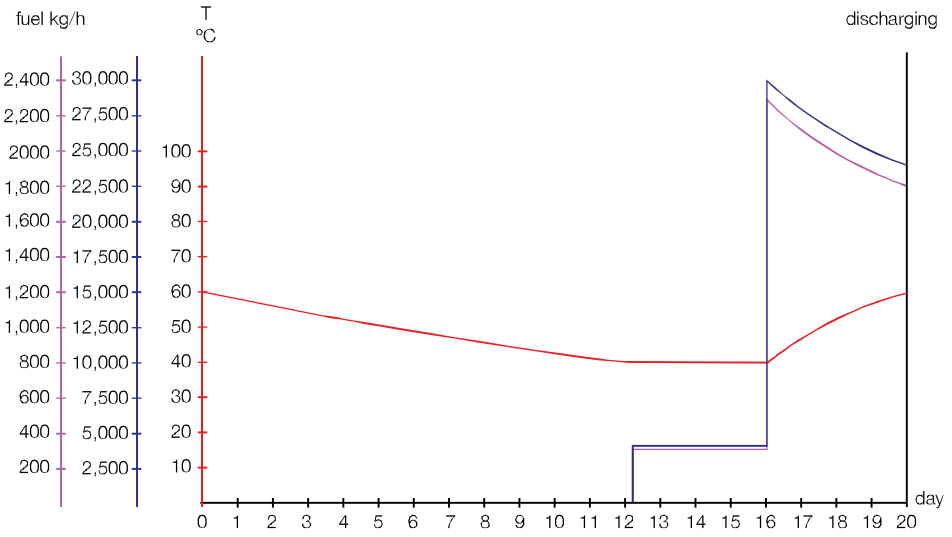
In the simulation mode the owner can generate his own plan, or several alternative plans, and decide which is the best, taking into account the external factors. The system can also be used for crew training.

This kind of planning is especially important while doing weather routing and making decisions about slow steaming. It gives the owner a more complete picture of the possible outcome.

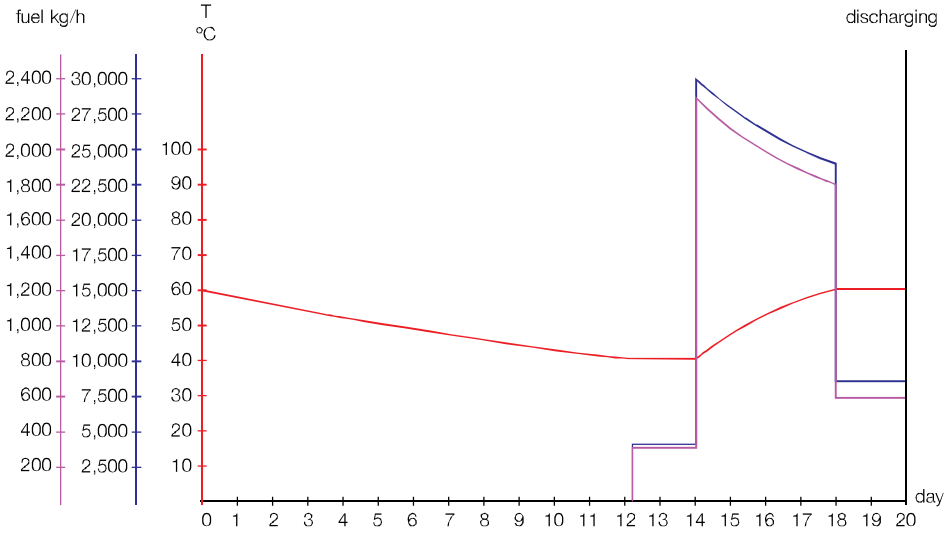
HeatPlan is not a magic tool, but it does offer the opportunity for fuel saving by optimising the cargo heating process, giving immediate payback. **TST**

**Dimitri Ivanov is the owner and president of JSC Marine Systems & Solutions*

2. Let the temperature go down to 40°C, maintain it at this point and then heat it to 60°C (plan 2)



3. Something in between, starting as plan 2, but beginning to heat two days earlier (plan 3)



4. How the optimum cargo scheduling profile would look