The Impact of Charter Party Speeds on CO2 Emissions

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1 Introduction

It is almost received wisdom at the IMO that ship owners are slow to adopt measures which would increase fuel efficiency, even when such measures are economic, that is, should have been adopted with no regulation at all. Here is how DNV puts it. "The results of this study indicate the lack of responsiveness to economics as a driving factor for change".[1] In general this is a misconception. Owners are acutely aware of fuel costs, and term charterers know how to distinguish fuel efficient ships from ships that are not.[2] Recently, tanker owners have instituted super slow-steaming down to 8.5 knots on ships that were not supposed to be able to do this.[3] This kind of slow-steaming was not even on DNV's list of measures that owners are alledged to be not adopting. Overall owners are responding to the massive post-2005 increase in BFO prices just about as fast as they can.

However, there is some truth in the consensus position. Markets do not always function perfectly. And there is at least one market imperfection that is currently having a substantial impact on owners' attempts to reduce CO2 emissions. That imperfection is tanker Charter Party speeds.

When a tanker is fixed in the spot market, the contract or charter party (C/P) usually specifies a speed that the ship is required to maintain on the loaded leg. For a variety of reasons, charterers tend to be very slow to change C/P speeds. For example, back in the late 1990's, Vela, the chartering arm of Aramco, fastened on 14 knots as their C/P speed. At the time, this was less than the economic speed which a competitive market would have come with for ships that could do more than 14 knots. Vela accepted the additional transportation costs of forcing ships to go less than the optimal ***for Vela*** speed because they knew that some ships could not do much more than 14 knots. By forcing all ships to the same speed it simplified their scheduling, which at the time was done manually. It is unlikely that Aramco headquarters even knew that Vela was subjecting Aramco to unnecessary costs.

In 2002 BFO prices starts rising and in 2005 to 2007 skyrocketed to unheard of levels. The economic speed in all but a boom market was pretty much as slow as you can go. Yet the Vela C/P speed remained at 14 knots. Other major oil companies reduced their C/P speeds slightly but only to the range of 13 or 13.5 knots. In late 2008, BFO prices plummetted; but since then they have recovered to around $600 per ton. Once again the economic speed is just about as slow as you can go, and now VLCC owners know how to slow steam down to 8 or 9 knots. Yet the C/P speeds remain in the 13 or 14 knot range, well above that which is optimal ***for the charterer*** even after accounting for cargo carrying cost.

The purpose of this note is to estimate the impact of these uneconomic C/P speeds on VLCC CO2 emissions.

2 VLCC Slow-steaming with and without C/P Speeds

Table 1 shows how a VLCC owner would react to the spot rate given $600 bunkers, accounting for cargo carrying costs, but with no Charter Party speed. For carrying costs, we assumed a cargo value of $730 per ton (about $100 per barrel) and a cost of capital of 5%. The VLCC we used is equipped with a full set of slow-steaming modifications. The ship was put on the RasTanura-Yokohama route, Malacca both ways.

The second column is round trip days. The third and fourth columns show the optimal steaming curve that is, the speeds that maximize owner's earnings net of carrying cost per day for each

[1] Det Norske Veritas, Pathways to Low Carbon Shipping, 2009-12-15
[2] Are owners and charterers really that stupid? CTX Technical Report, 2011.
[3] Bockmann, M, VLCC next to turn to super-slowsteaming to cut costs, Lloyds List, 22 February 2011.

WS	DAYS	LD SPD	BL SPD	MARGIN	INVCST	C02/TPD
25	65.82	8.50	9.50	481817	950559	1.0729
30	62.42	9.50	9.50	704825	856331	1.1108
35	60.97	10.00	9.50	964928	816284	1.1332
40	59.66	10.50	9.50	1223854	780052	1.1574
45	58.47	11.00	9.50	1480130	747113	1.1847
50	57.39	11.50	9.50	1732542	717038	1.2164
55	55.91	11.50	10.00	2000358	716907	1.2207
60	52.37	12.00	11.00	2177769	689089	1.2662
65	50.35	12.50	11.50	2387410	663610	1.3048
70	49.33	12.50	12.00	2650676	663474	1.3138
75	46.77	13.50	12.50	2792455	618291	1.3871
80	46.77	13.50	12.50	3093667	618291	1.3871
85	44.38	14.00	13.50	3244840	597892	1.4418
90	43.64	14.00	14.00	3500317	597747	1.4549
95	42.27	14.50	14.50	3687863	578894	1.5001
100	41.63	14.50	15.00	3937861	578736	1.5168

Table 1: VLCC Speed up Curve PG-East, BFO $600/ton, No C/P speed

spot rate.[4] It turns out that these are the ship's optimal speeds regardless of whether this is an owner in the spot market who is attempting to maximize his profits in the face of carrying costs or a term charterer who is trying to minimize his transport costs, including cargo carrying cost. See The Impact of Bunker Prices on VLCC rates, Appendix B for proof. The fifth column shows the owner's voyage margin (exclusive of OPEX and CAPEX), and the sixth column the cargo carrying cost. The last column shows the tons of CO2 emitted per ton per day of oil delivered. In other words, the fleet size is adjusted to deliver the same amount of oil.

Table 2 shows exactly the same calculations except we have forced the owner to go 14 knots loaded.

WS	DAYS	LD SPD	BL SPD	MARGIN	INVCST	C02/TPD
25	53.12	14.00	9.50	-63241	598888	1.4173
30	53.12	14.00	9.50	238325	598888	1.4173
35	53.12	14.00	9.50	539891	598888	1.4173
40	53.12	14.00	9.50	841457	598888	1.4173
45	53.12	14.00	9.50	1143022	598888	1.4173
50	53.12	14.00	9.50	1444588	598888	1.4173
55	53.12	14.00	9.50	1746154	598888	1.4173
60	50.31	14.00	10.50	1979773	598668	1.4066
65	47.99	14.00	11.50	2210371	598440	1.4057
70	46.98	14.00	12.00	2473637	598317	1.4096
75	46.04	14.00	12.50	2733826	598185	1.4170
80	46.04	14.00	12.50	3035038	598185	1.4170
85	44.38	14.00	13.50	3244840	597892	1.4418
90	43.64	14.00	14.00	3500317	597747	1.4549
95	42.95	14.00	14.50	3753587	597594	1.4702
100	42.31	14.00	15.00	4003585	597432	1.4883

Table 2: VLCC Speed up Curve PG-East, BFO $600/ton, 14 kt C/P speed

At $600 bunkers and low spot rates, the market optimal loaded speed is in the 10 to 11 knot range even accounting for cargo carrying costs. The 14 knot C/P speed forces the owner to go 3 or 4 knots faster loaded than he would voluntarily. The result is that there is a big difference in CO2 emissions. For example at Worldscale 45 (WS45), about the current rate, the difference is just under 20%. And it is precisely at the bottom of the market that we have the ships available to slow-down and still move the same amount of oil.[5]

[4] These voyage calculations were done by the MFIX voyage analysis program. MFIX optimizes speed in half knot increments, so the speed up is a little jumpy. The slight drop in inventory carrying cost with increasing spot rate in Table 2 is due to a slight reduction in cargo deadweight due to the increased bunkers required.

[5] Of course, if the C/P speed is reduced and the fleet on average slows down, then spot rates will rise. At the end of

It is easy to see that, below WS80, the 14 knot C/P speed is not economic. For example, at WS45, if the owner were allowed to go the optimal loaded speed of 11 knots, his voyage margin would increase from 1.143 million dollars to 1.480 million. But the loaded leg would increase by 5.4 days increasing in-transit cargo carrying costs from $599,000 to $747,000. The owner could take $148,000 of his extra margin and give it to the charterer to compensate for the increase in carrying cost, and still have $189,000 left over. Of course, he has tied up his ship for an extra 5.4 days. At WS45, this costs him $25,300 per day or $137,000. Bottom line there is $52,000 available which the owner and charterer could somehow share by eliminating the C/P speed. Everybody wins. In a perfectly functioning market, this kind of gravy simply isn't available.

These computations also pretty much tell us why this sort of market imperfection persists. $52,000 is not a lot of money in a charter for which the gross charter hire is about 2.2 million dollars and the inventory carrying costs are of the order of $700,000. The speed optimum is fairly flat so the loss to the owner/charterer of being off in speed is a small percentage of the overall deal.

Yet the difference in CO2 emissions can be quite substantial.

3 Name and Shame

The obvious question is: what to do about this market imperfection?

In CTX's opinion, this is one of the few cases where name-and-shame should work. The oil companies are very conscious of their environmental reputation or at least the public's perception of it. They have nothing to lose from reducing C/P speeds to near-optimal.[6] In fact, they will gain a few bucks.

the day, the loaded speed will not be the WS45 speed, but something slightly higher.

[6] "Optimal" here refers to market optimal. The market prices the cost of CO2 emissions at zero. If CO2 emissions were more properly priced, then the optimal speeds would be still lower. The CTX has argued that by far the best way of integrating the social cost of CO2 pollution into the owner/charterer calculus is a tax on CO2 stack gas emissions. See Direct Taxation of Ship-based CO2 Emissions. About the worst thing we can do is to impose EEDI. See The Impact of EEDI on VLCC Design and CO2 Emissions.