INDUSTRY VIEWS ON THE SCOPE FOR CARBON EMISSIONS REDUCTION WITHIN THE SEA FREIGHT SECTOR, CHARTING PROGRESS TOWARDS TRANSITION.

T. Canning

IMarEST student member, PhD student Warsash School of Maritime Science and Engineering
Southampton Solent University, East Park Terrace, Southampton SO14 0YN theresecanning64@gmail.com

ABSTRACT

This paper will be build and update on work submitted a year ago on carbon emissions reduction. The original Master of Science dissertation consisted of a combination of industry EEDI data, interviews with very low carbon operators, an on-line survey, and data extracted from 39 podcast interviews. That dissertation found that carbon reduction technology is being used, and that, in general, industry attitudes and behaviour were consistent with the IMO's stated carbon reduction target, but that the improvements were largely based on engineering solutions as opposed to changing to renewable fuels.
The purpose of this paper will be to examine attitude changes which have occurred in the past year, using textual analysis techniques of the Shipping Podcast. The Shipping Podcast is an initiative set up by Lena Gothberg, who has been in the industry for over 25 years. Her interviews have now been downloaded over 85,000 times and are listened to in over 140 countries. Her mission is to 'meet interesting people with a story to tell. Inspired by my shipping friends and my new friends in the digital world, I have decided to spread the word about the coolest industry on the planet and help raise the profile.' The paper will also look at other indicators such available EEDI data.
The presentation of the paper will focus on transition technologies, current developments and the most recent analysis of the Podcast,

Keywords: Shipping, transition, attitudes, heavy weather

NOMENCLATURE

EEDI Energy Efficiency Design Index, gCO2/t-nm. Mandatory for new ships since 2013, phased reduction of EEDI up to 2025. Based on the features of a ship as built.
EEOI Energy Efficiency Operational Indicator, gCO2/t-nm. EEOI is being developed as a tool that can help ship operators follow their SEEMPs, based on the emissions of a ship in operation.
EETI Estimated Technical Efficiency Indicator (sic), gCO2/t-nm. A measure that takes into account the changes that occur in EEOI because of wear and tear or hull fouling, a work in progress.
EVDI™ Existing Vessel Design Index, gCO2/t-nm. A commercial tool that can assign an EEDI to a ship built before 2013, or can update an EEDI where change has occurred, such as, retrofitting.
gCO2/t-nm Grams of carbon dioxide emitted per tonne per nautical mile A measure that is used to determine the energy efficiency of a ship.
MPM Mentions per minute A fairly subjective measure used to analyse themes mentioned in the Shipping Podcast interviews.
MRV Monitoring, reporting and verification of carbon emissions from ships. Mandatory from 2018 in the EU, data from MRV is planned to inform future IMO policy.
SEEMP The Ship Energy Efficiency Management Plan. Mandatory for all ships since 2012, a mechanism to improve the energy efficiency of a ship.

1. INTRODUCTION

The background to this paper is the increasing need to reduce greenhouse gas emissions (GHG) in all areas of industry in order to curb and reverse the effects of anthropogenic climate change. NASA (NASA, 2017) has reported that July 2017 saw the hottest global temperature yet recorded, very slightly higher than that for July 2016. The recordings of carbon dioxide (CO2) from the Mauna Loa Observatory (SCRIPPS, 2017) over the past two years show that the concentration of atmospheric CO2 has been over 400 parts per million (ppm) for most of that time, up from 316ppm in 1958. The environmental and human consequences of these changes have led to the development of studies into how we can best tackle the problem of reducing carbon emissions in a way that has positive outcomes for the people, the economy and the environment. Shipping, along with nations, industries and individuals has its part to play in reducing use of fossil fuels, and hence reducing the amount of carbon dioxide in the atmosphere. The area under investigation in this study is the sea-freight sector. That is the

roughly 90,000 vessels that carry cargo around the world. The specific area of study is current GHG reducing practices within this sector. The factors which are inhibiting greater take-up of new advances in technology and seeing how change operates in this sector from a multi-level perspective (MLP). This paper principally focusses on the culture for change as expressed through the 65 podcast interviews, recorded over the past two years.

2. MODEL OF TRANSITION

In the model below it is envisaged that the transition to lower emitting technologies would come about as the niche-level operators are able to maximise opportunities which arise in the socio-technical regime of the shipping industry, as a result of a move away from fossil fuels.

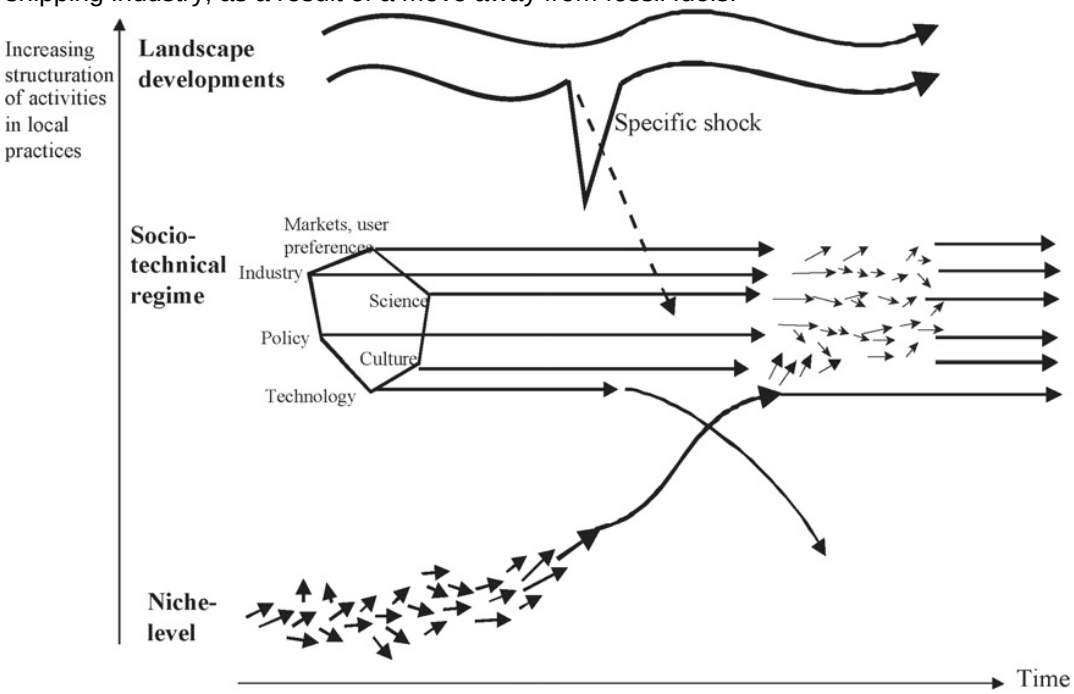

Figure1 showing the technological substitution pathway as developed by Geels and Schot (Geels, 2007).

2.1 NICHE-LEVEL VERY LOW CARBON FREIGHTERS

The conclusions from last year's study were broadly positive. A range of data sources was used to form an impression of the way that niche participants and low carbon strategies were being adopted in the sea freight sector. A few semi-structured interviews were conducted with people involved with low carbon shipping. Both full length interviews concerned wind propulsion, one from the perspective of a very small wind powered freighter, and one from the secretary of the International WindShip Association (IWSA). The small operator is of the opinion that although the wind-powered sector is still miniscule, some companies are looking at containerisation, thus being able to breakthrough into containerised ports, and that there is plenty of as yet untapped potential for incorporating sky sails onto conventional vessels. In his opinion one of the biggest barriers is conceptual, companies not 'thinking outside the box'. He also stated that revising and updating the international regulatory framework governing shipping is, at present a daunting task but does need to happen if a transition to a fully sustainable freight sector is to be achieved. The WindShip representative also cited 'lack of vision' as a barrier to transition but was generally optimistic about the future because, in his opinion, industry attitudes are changing from 'why should we reduce emissions' to 'how can we reduce our emissions', and that wind propulsion research is beginning to mature and can be seen as one the 'tools in the box', he commented that weather routing software is being used quite widely as it seems to work and costs a few thousands of pounds as opposed to many other measures which can cost millions. Follow-up interviews with very low carbon operators have not been conducted, however information from social media sources indicate that the companies involved in sail freight are growing, diversifying and enmeshing themselves within new structures as part of sustainable supply chains.

3. SURVEY RESULTS

The survey sought answers to three types of question. The first three questions covered data protection, the respondent's role as a stakeholder and their organisation's position within the sea freight sector. Questions 4 to

9 covered available technology and the extent it is being used by their organisation now or in the near future. Questions 10 to 14 focussed on current policy and practices, barriers and drivers. The final question related to their organisation's aims for the future.

Although the number of responses was disappointing, the responses tended to indicate that companies are taking action to reduce emissions. The technology questions covered, hulls, alternative propulsion systems, propeller systems, new engine design, alternative energy sources and weather routing software. Weather routing software is being used by over 75% of the respondents. The results show an interesting range of technologies being either used or seriously considered by the respondents. Most of the options offered are being implemented to some extent by about 50% of the respondents.

The policy and attitude questions covered slow steaming, the extent to which emissions are considered throughout the shipping process, factors impeding progress (barriers), factors encouraging progress (drivers), and the extent to which the IMO 2050 target is considered within their organisations. 87.5% of respondents said that slow steaming is not an adequate strategy, a result which had a p-value of 0.002 where n = 16, or a 1 in 500 probability of occurring by chance. 50% of the respondents regard their emissions as the most important factor at the commissioning and operational parts of their business but this figure drops to 33.33% for the disposal of ships and 33.33% not considering emissions at all when ships are disposed of.

40% of the respondents regard the IMO target as of central importance with another 46.67% opting for 'quite important' or 'as important as other factors', which seems quite encouraging, on the other hand, 60% of the respondents don't think the IMO target is of central importance. The supplementary section to this question asking 'how this can be achieved?' consisted of the four following comments: 'kicking and screaming', 'Provide industry a tool to benchmark and measure CO2 emissions and preference more efficient ships.', '100% renewable ships', and 'Using ongoing advances in technology'. A recent article in Lloyd's List posed the question 'What will power shipping in 2050?' to eleven industry experts, some of whom have also appeared on the Podcast. LNG and wind were the clear favourites. Hydrogen and electric cells were also mentioned frequently. Here are a couple of quotes which highlight the issue of diversity of views within the industry "From the ship-owner's perspective, my bet is on LNG, with bio fuels a distant second. The key to making a good prediction must also consider how, where and when the shore-based infrastructure will grow and meet the demands of the global industry. For example, given the scarce shore infrastructure for LNG, the industry is focused now on dual-fuel vessels… Stating the obvious, ship-owners building ships for global trade must have the confidence that fuel will be available and thus the development of the shore-based infrastructure and fuel supply chain will be critical." "Yet, towards 2050, the main driver of alternative energy sources will largely depend on the implementation of an effective carbon pricing mechanism for shipping. A global target and a measure to reduce in-sector emissions consistent with the Paris Agreement will likely benefit power-to-liquid fuels (such as hydrogen and methanol) for larger ships, and battery electrical solutions for shortsea shipping." (Kinthaert, 2017).

4. EEDI DATASET

The EEDI data indicated that the 615 ships classified between 2014 and mid 2016 by RightShip (Rightship, 2016), were exceeding the IMO targets, the median values of the data reduced by 9.196% over the whole period, or just under a third of a percent per month over the 30 months this dataset covers. A linear regression was performed on the data which produced the graph below, the interesting thing about the graph is not so much the slope of the regression line, but the number of newer ships which fall below the line. The order book for 2016 was a bit thin and the improved energy efficiency may be explained by the size of the vessels on order as opposed to the widespread use of technologies that could be described as a transition to low carbon shipping. (Canning T. M., 2016). According to (CE Delft, 2017), 'the efficiency improvements seem to have stalled in 2016. On average, the design efficiency of new bulk carriers, tankers and gas carriers was worse in 2016 than they were in 2015. Also the share of ships below the reference line and the share of ships meeting or exceeding Phase 1 Phase 2 or Phase 3 required EEDI values has decreased in 2016. The design efficiency of container ships and general cargo carriers was more or less at the same level in 2016 as in 2015.' The stalling of improvements may partly be explained by the methodology used in the study, or broader economic factors, although surely building a ship that is cheaper to run in the long term would benefit everyone.

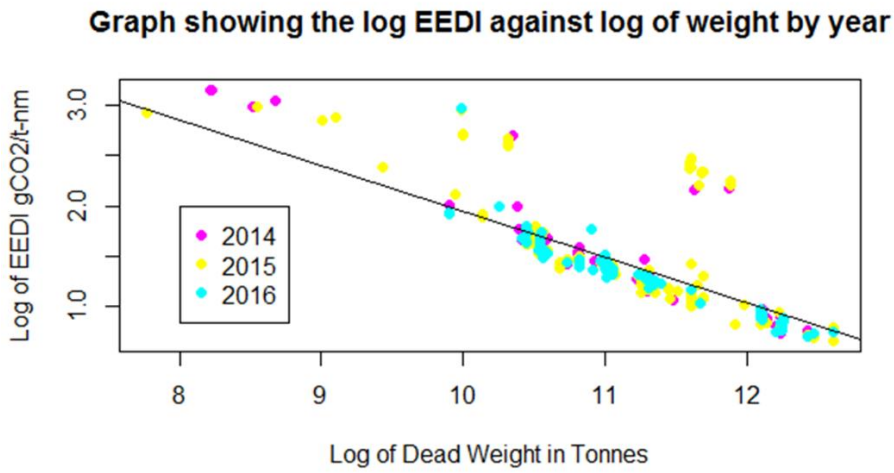

Figure 2 showing the natural logarithm of verified EEDI of vessels against the natural logarithm of dead weight in tonnes by year, n = 615 p value 2.2-16, negligible, which is a result of the EEDI methodology and is to be expected (Canning T. M., 2016).

5. THE PODCAST

About two years ago, Lena Gothberg (Gothberg, 2016), a Swedish marine insurance broker and active member of the Women's International Shipping and Trading Association (WISTA) launched The Shipping Podcast. She conducts her semi-structured interviews with people who are involved with the industry. Although some of the questions have changed throughout the sixty-five broadcasts so far, the basic framework has remained the same. She asks her interviewees to introduce themselves, to describe what they do on a day-to-day basis and the nature of the organisation they work for. This usually leads to a discussion of the particular interests and expertise of the interviewee. Each interviewee is asked about how the visibility of the shipping sector could be increased, how young people can be attracted to the industry, if the interviewee has a role model, what the future might hold for the industry, and finally if the interviewee can suggest another suitable candidate. As one of Lena's stated aims is to attract women to work in the shipping sector, and through her contacts at WISTA, a far larger proportion of her subjects have been female, just over 52% so far, as opposed to an estimated 2% in the shipping industry as a whole (ITF, 2016), and even fewer in the sea freight sector. There are problems with this way of gathering information. At first the audience was small, mostly Swedish, and the interviewees didn't seem to be overly self-conscious. As the Podcast has evolved, with tens of thousands of listeners in over a hundred countries the interviewees seem to have become warier about what they say. Most of the interviews are with people in senior or very senior positions, some interviewees have suggested that she talks to young, junior people but that doesn't seem to have happened, yet. A barrier to full inclusivity is that it is recorded and broadcast in English, Lena has defended this position with the argument that if she had conducted and broadcast in Swedish, it would not have had anything like the exposure that it has received, and she is probably right. The Podcast is broadcast every other Friday and has been for the past two years with the odd bonus episode but that doesn't represent the time frame in which they are recorded. Quite often a group of recordings are made at conferences and then issued fortnightly afterwards. As the Podcast is not meant to be a newspaper this is not much of a problem, and Lena usually points out issues or topics that may have changed between recording and broadcast. The big uncertainty is editing, Lena has become increasingly skilled as an interviewer, producer and editor, it is not known how much of the material she has recorded is not broadcast. The total length of the podcasts was 40.5 hours (2430 minutes), during which time one felt that the vast majority of interviewees were speaking in good faith and not speaking from pre-prepared scripts or marketing material. As the podcast has become more successful, one gets the feeling that a very few of the interviewees are using it as a sales pitch. Lena herself has become more polished in her delivery and technique and she has been able to get some advertising from such companies as The Swedish Club, which may have an effect on who is interviewed, the questions asked and the responses given, but, thus far there is no concrete evidence of this.

Notes were taken of the sixty-five interviews and a spreadsheet generated of mentions of issues that coincided with either the on-line survey or the open-ended interview framework developed for this project. The very first podcast (Gothberg, 2016) was not included in the analysis as it was a pilot episode outlining Lena's goals for the podcasts, it wasn't an interview and parts of it which are repeated in every episode were not included either. The spreadsheet contained a count of issues as follows. Climate change, which included references to

environmental responsibility and emissions reduction. Design, which covered new builds and retrofits. Fuel, which included fuel saving and alternative fuels. Tech, which included IT systems for weather routing and uses of emission reduction technology. End, which dealt with scrapping vessels. Barriers, drivers and references to the future were noted as well as optimism or pessimism about the industry as a whole (this was not included in the detailed analysis as it was too nebulous). The length of each podcast was noted in minutes, alongside the gender of the interviewee and whether they were in the industry or not, some of the interviewees were academics, or in other connected activities such as security and rescue.

The count data was transformed into 'mentions per minute' (MPM) by dividing the count of each criterion in each interview by the number of minutes in that interview. This was combined into a new dataset. The new dataset makes it easier to analyse trends over time. The data was also grouped into 'tangible' and 'intangible' criteria to fit with the methodology of the survey (questions 4 to 9, and 10 to 14). Is isn't graphed here as it didn't seem to shed much light on the issue as a whole. There wasn't a statistically significant link between either gender or role and interview responses about climate change.

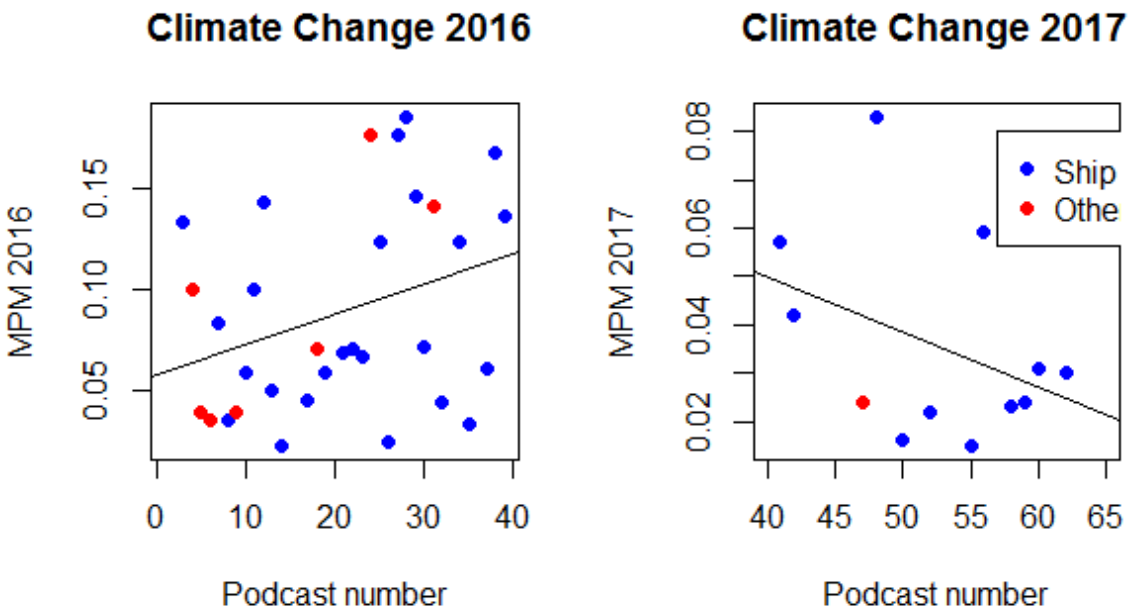

Figure 3 graph showing mentions per minute of climate change in the 2 groups of podcasts. The blue dots are responses by people within the industry, the red dots are responses by non-shipping people such as consultants and academics (Canning, 2017).

The 2016 graph shows an upward trend throughout the first 39 episodes, which could be attributed to the 'Paris Effect', textual analysis of the notes does not reinforce or refute this idea. The most recent 26 interviews show a marked trend downwards which is confirmed by the written notes taken of the interviews

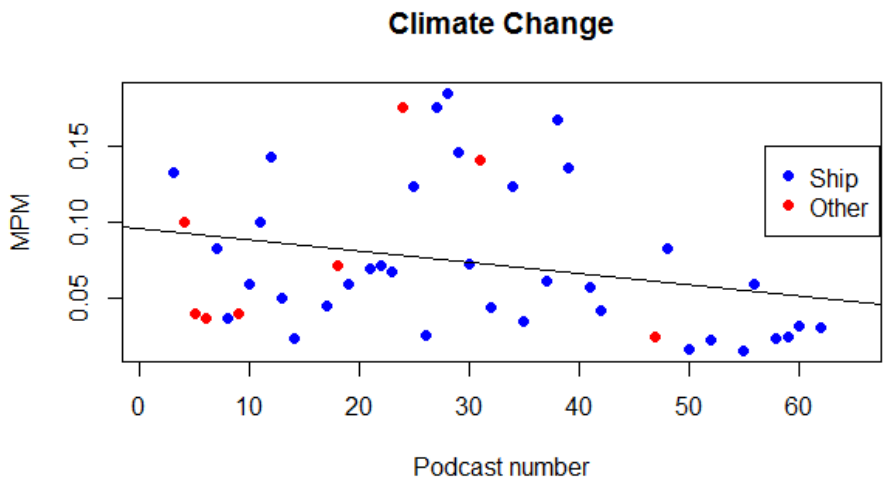

Figure 4 graph showing mentions per minute of climate change in the 65 podcasts. The blue dots are responses by people within the industry, the red dots are responses by non-shipping people such as consultants and academics (Canning, 2017).

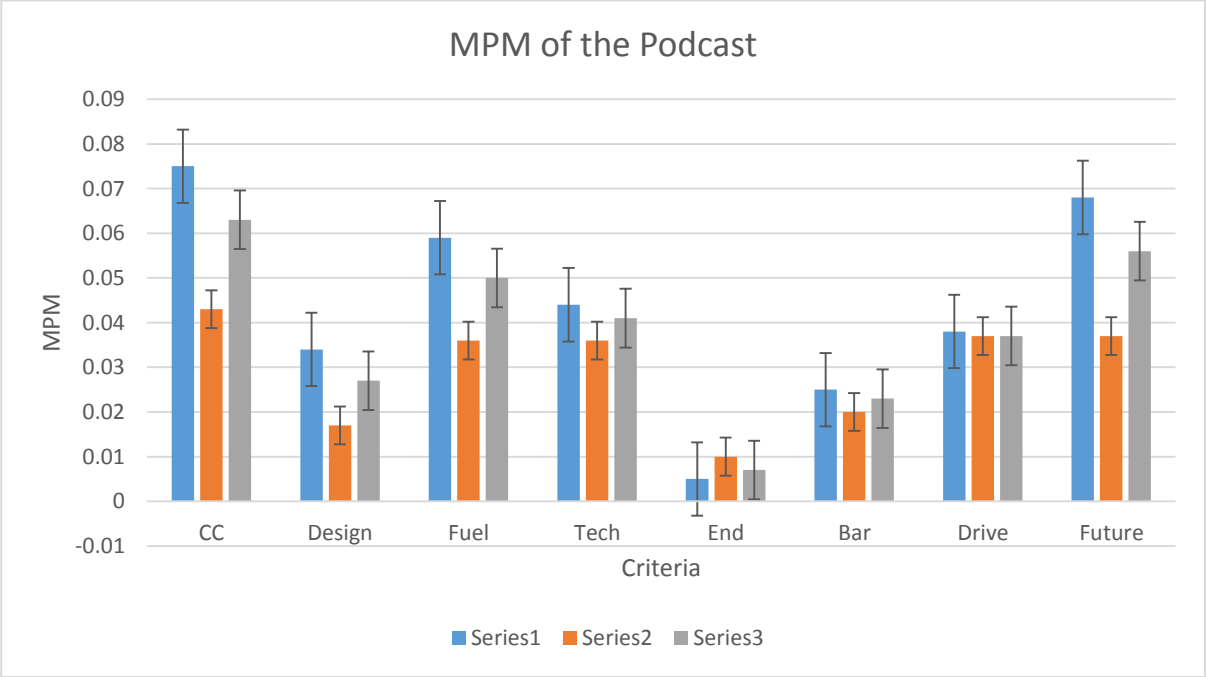

Figure 5 graph comparing mentions per minute of the eight Podcast criteria noted in 2016, blue, 2017 orange and combined, grey (Canning, 2017).

The graph above shows mentions per minute of eight of the criteria studied, with the exception of ship scrapping, all of the criteria were mentioned or discussed less frequently as the Podcast continued. Many of the newer conversations related to the ways in which digitalisation may impact on shipping. Many of these innovations may impact on energy consumption and emissions but probably at the margins and isn't really part of the debate about shifting away from fossil fuels. Ship scrapping or 'recycling' was barely mentioned throughout the Podcast and the very limited survey results also reinforced the idea that it is not a topic that the industry likes to discuss in public.

Alongside the dataset, notes were taken of each podcast, these were then processed to produce word-clouds of specific barriers and drivers as the dataset results about barriers and drivers weren't particularly enlightening. In general, the interviewees mentioned drivers more often than barriers throughout the interviews.

Drivers in brown

Barriers in pink

Below are a few quotes from the Podcast with their interview numbers and who said them
005 Captain Jörgen Lorén IMO is changing not 'a whole of old sailors and lawyers' anymore.

006 Professor Richard Watson 'Energy + information = less energy'

009 Per Erling Evensen 'Ships are like towns' with a 'community at sea'.

011 Helen Jansson Scrubbers need salty water, don't work so well with ice. The Baltic is not very salty and has ice.

012 H Danae D. Bezantakou, History of shipping, some families have been in it for 200 years. This history should be more extrovert, but there is reluctance to share too much in case unsympathetic people jump on the bandwagon with unscrupulous practices, it has made a good living for many families and they don't want it spoilt.

031 Tristan Smith 'Incremental improvements improve efficiency, but isn't transition.'

034 Kathi Stanzel EU and US can make onerous regulations. IMO is no longer an expert body as not so much seafarers, more political. Political issues are being hidden behind technical discussions IMO leadership as an issue.

035 Kate D Adamson 'Shipping doesn't need better PR, it needs to get better. It needs to be more transparent. Parts of it might disappear such as agents and brokers.

037 Di Gilpin 'Niche projects can be a billboard for the whole industry'. Decoupling of ship's motive power from the bunker infrastructure. Off grid shipping.

040 Carleen Lyden-Kluss We are not 'cowboys at sea'

050 Peter Hinchliffe BWM 2004 not a fan, should have been ratified back in 2006 – the boom years. 'Signed on Friday 13th Feb 2004, so it got off to a bad start'.

058 Christopher Rex, Head of Research at Danish Ship Finance '60% of shipping is basically moving liquid energy around the world.'

065 Roger Adamson Disintermediarisation- intermediary players being removed.

6. CONCLUSION

The updated EEDI data and this year's podcasts would indicate that the industry's focus is shifting away from carbon emissions reduction to economic concerns in a very difficult market. The Podcast also saw a shift to discussing the 4th industrial revolution which does envisage shifts in energy generation, consumption and organisational change. The external political landscape has changed since the Podcast began and there were very few allusions to the election result in the US, for example. Historically change in shipping has been a very slow process with ships changing to new fuels after the engineering issues have been ironed out in other industries. There does seem to be a sense amongst many in the industry, that the next energy transition and other transitions, towards automation, for example, could be led by the shipping industry. This idea could apply

to some of the experimental and development projects which have received funding recently. Last year's paper concluded with cautious optimism, after hearing some of the interviews from this year it is hard to remain quite so optimistic. Possibly, it could be argued that energy efficiency and endeavouring to cut emissions is embedded into the discourse, so doesn't need re-iterating at every turn. The stalling of the reduction in EEDI along with the changing political context would suggest otherwise.

ACKNOWLEDGEMENTS
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