Circumnavigating Efficiency: Harnessing GIScience to unveil the Hidden Emissions from the Deliberate Drifting of LNG Carriers

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Abstract Maritime trade is a significant contributor to greenhouse gas (GHG) emissions. For this reason, recent amendments to the International Convention for the Prevention of Pollution from Ships (MARPOL) have focused on curbing not just pollution but also the GHG emissions that arise from shipping. These developments have introduced the mandatory measurement of energy efficiency for ships beyond a certain tonnage, in accordance with an annual operational Carbon Intensity Indicator (CII) devised by the International Maritime Organisation (IMO), effective since 2023. The IMO uses the CII indicator as a criteria for imposing corrective actions on ships achieving low ratings. Plainly defined as the ratio between a vessel's carbon emissions and its total mileage over a year, the CII has, as this research will seek to demonstrate, resulted in vessels with otherwise low ratings deliberately travelling longer distances for the sole purpose of increasing their ratings to a favourable value. Instead of navigating for the purpose of making progress towards a destination, these vessels intentionally sail in circles – in effect causing greater emissions than would otherwise have occurred. In one particular instance a vessel has been observed sailing aimlessly for nearly a month (lengthening its journey by a factor of 3.3), rendering the CII an inadequate instrument for its purpose. This phenomenon is prevalent among modern liquefied natural gas carriers (LNGCs). Due to the unstable nature of their super-chilled cargo, these vessels are by design unable to come to a stop as long as they are laden. This is due to the fact that their engines are built to run on the "boil-off" gas (BOG) that evaporates from the holds as the LNG inevitably heats up along a journey. Idling LNGCs could manage BOG by means of flaring or by re-liquefying it onboard, but are instead compelled to sail in circles to ensure that even as their emissions increase, so too does their mileage, keeping the vessel's overall CII ratio stable. Flaring or re-liquefaction could potentially be less emissions-intensive than aimless sailing, but the latter strategy is preferred so as not to incur penalties. At the same time several shipowners are reaping benefits, thanks to their seemingly virtuous ratings, which allow them to apply for sustainability-linked financial facilities. This research employs advanced GIS techniques able to accurately distinguish purposeful navigation from aimless drifting. This is done in order to understand the scale of this phenomenon and quantify the nautical miles travelled and the associated greenhouse gases emitted as an unintended consequence of the introduction of the CII indicator. The ultimate goal is to create a replicable methodology that can empower decision-makers to formulate more equitable and effective climate mitigation policies for the maritime industry.