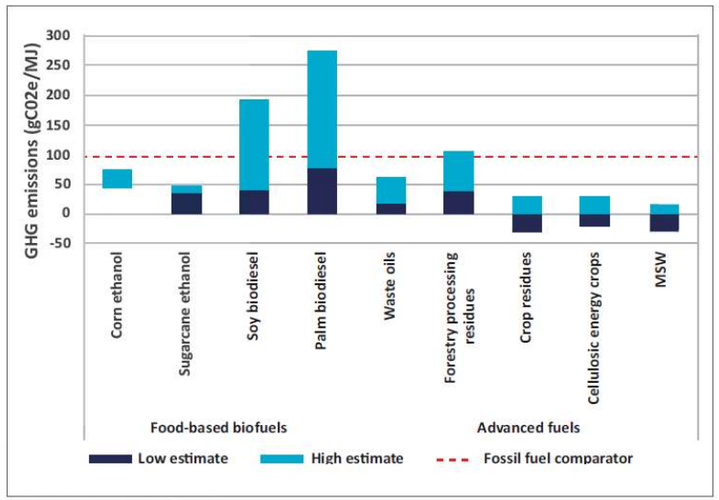
Work Group #4: Sustainable Marine Fuels

Deliverable 3.1 Report Review Template

1. Report title	**The Role of Sustainable Biofuels in the Decarbonisation of Shipping: The findings of an inquiry into the Sustainability and Availability of Biofuels for Shipping**
2. Publication date	5 December 2019
3. Author	Sustainable Shipping Initiative (SSI) SSI is an initiative with members from different stakeholder groups (Ship owners, charterers and operators/Banks and insurers/Classification societies/Marine service provider/Environmental NGOs/Ship recycling)
4. Client (organization and type of organization, specifying private/commercial/public; research institute/interest group etc.)	No third party client is mentioned.
5. Context of study (e.g. project in the context of which report is published or titles of other reports if part of a series)	SSI Roadmap Vision Area 6: Energy
6. Length (pages)	24
7. Link (or where to get if not available online)	https://sustainableworldports.org/wp-content/uploads/SSI_2019_The-role-of-sust.biofuels-in-decarb.-of-shipping-report.pdf
8. Sector coverage	Maritime shipping
9. Main aim of the study	The study aims to • explore the potential role (if any) of biofuels in the decarbonisation of maritime shipping.

	• outline the findings of an inquiry by the Sustainable Shipping Initiative into the sustainability and availability of biofuels for shipping.
10. Methodology	Stakeholder consultation (interviews, roundtables, webinar, conference panel), desktop literature review
11. Topic(s) and indication of the level of detail For example: • System Description - *A description of the full marine energy system.* • System Components - *A description of all the components.* • Infrastructure requirements for new fuels • Applicability - *which of the new fuels are expected to replace existing fuels?*	• Introduction – *Description of the topic of biofuels for shipping and the SSI's inquiry process* • Sustainability issues around biofuels – *Description of key sustainability considerations* • Potential availability of sustainable biofuels – *Extensive description of availability of sustainable biomass for shipping* • Findings – *Short description of main findings of the inquiry.* • Conclusions and recommendations – *Description of risks and opportunities of biofuels for shipping and recommendations for further work.*
12. What are the main conclusions from the report?	• It is not yet clear which of the potential zero-carbon alternatives to fossil fuels for the shipping industry has the winning combination of availability, sustainability and competitiveness. As biofuels could be used as drop-in or blends, their use can be considered most technologically ready. However, there are large concerns with respect to the sustainability and availability of biomass. • The most contentious impacts of biofuels relates to their full life cycle carbon credentials and indirect impacts on land management and food production systems. Energy crops pose the highest risk of indirect impacts, notably palm and soy. Lower sustainability risks are related to biomass wastes and residues. No single biofuels certification scheme currently addresses the concerns around indirect and systemic impacts. • The SSI inquiry has adopted a working assumption of 50-100 EJ as the range of available sustainable biomass by 2050. The availability of biomass for shipping depends on the development of biomass demand in other sectors, notably the aviation sector. There is a significant probability that the available biomass for shipping will be insufficient to meet the entire energy demand of the shipping sector.

	• When asked for their views on the percentage of which shipping's energy needs would be met by biofuels in 2030 and 2050, the majority of stakeholders agreed this would fall in the 10-30% range. Further, stakeholders anticipated that biofuel use would be higher in 2030 than 2050, implying this is a short rather than long-term solution. • All stakeholders who supported the use of biofuels considered certification to be a prerequisite to ensuring the transparency and sustainability of biofuel supply chains, but some believe this is not sufficient.
13. What fuel/energy type(s) are discussed in the report and in what level of detail? For example: • Fuel description e.g. type, energy density, specific energy density, flash point, boiling point, fire point, flammability limits, hazards	Biofuels in general are discussed, mostly regarding the availability and sustainability of the biomass feedstocks that are needed for the production of biofuels. Ammonia and hydrogen are shortly mentioned as sustainable alternatives for the shipping sector, but not discussed any further.
14. What environmental aspects does the report consider? E.g. Air quality emissions, climate change emissions (GHG + BC), other (for example terrestrial or underwater noise, water quality, emergency releases, fugitive emissions, odour, water resources, mining)	Mostly indirect land use change (ILUC) and GHG emissions. Soil quality, air quality emissions, water quality and biodiversity are shortly mentioned.
15. Does the report consider exhaust emissions only, or life-cycle, or both (or some other range of emissions)?	Exhaust emissions and life-cycle emissions are considered.
16. If determined in the report, what are the emission rates/factors by pollutant? NOx, SOx, PM10, PM2.5, ultra fine PM, VOC, NH3, GHGs, Black carbon, and any others e.g. that may be unique to the fuel/energy.	The report presents GHG lifecycle emission factors (gCO_2e/MJ) of food-based and advanced biofuels from the literature:

	 ***Figure 6: Comparison of lifecycle GHG emissions associated with different biofuels (MSW refers to Municipal Solid Waste)*** *Source: ICCT, 2019*
17. Does the report discuss barriers and opportunities for <u>ships</u> to use the fuel(s)/energy? Does the report identify the maturity level of the fuel on a regional or global scale with respect to use by vessels?	The report mentions one general opportunity related to using biofuels to power ships: it requires only minor modifications to ships. Other opportunities for ships are not given. Several economic, environmental and institutional barriers are discussed, among others: • availability of sustainable biomass feedstocks for the shipping sector • competing demand for biomass in the aviation sector and other sectors

	• possible negative environmental effects of using biofuels and related possible opposition from society and reputational costs for the shipping sector • sunk costs of investing in a temporary solution • biofuels might only be a shorter-term solution until alternatives become available • coordination and engagement across all interested sectors and the entire shipping value chain is required The maturity level of biofuels is not discussed.
18. Does the report discuss barriers and opportunities for <u>ports</u> to provide the fuel(s)/energy? Does the report identify the maturity level of the fuel on a regional or global scale with respect to provision by ports?	Several economic and institutional barriers are discussed, among others: • significant restructuring of fuel production, distribution and logistics systems is required • uncertainty in which bunkering infrastructure ports should invest • biofuels might only be a shorter-term solution until alternatives become available • sunk costs of investing in a potential temporary solution The maturity level of the fuel with respect to provision to ports is not discussed.
19. Does the report include capital and operating cost estimates for the ship and/or land-side?	No.
20. When are the fuel(s)/energy expected to be at a demonstration stage vs. commercialization? For example: • Technology Readiness Level of the system - *Estimated maturity of the system technology* • On Board Safety Readiness Level of the system - *Estimated maturity of the risk mitigations on board (on a scale of 1-9)*	This is not discussed.

• External Safety Readiness Level of the system - *Estimated maturity of the risk mitigations for bunker operations (on a scale of 1-9)*	
21. Are the fuels suitable for short and/or long (trans-oceanic) voyages?	This is not discussed.
22. Does the report identify/discuss potential issues around community acceptance for this fuel, or potential social/community impacts associated with the system?	Yes, the possible impact of increasing use of biomass for biofuel production and other applications on future food availability and food prices is discussed. Also, this may divert materials that were previously used in other markets, leading to shortages in those markets. Furthermore, social issues related to the use of biomass for energy purposes are listed, including the allocation of land for energy crops production, changes in income, changes in the amount of jobs, and injury, illness and fatalities related to biomass feedstock production.
23. Other?	It is mentioned that the literature on biomass availability does not agree on the amount of sustainable biomass that could become available in the future. The availability depends, among other things, on population growth, meat consumption and innovations in land management. It follows that the working assumption in the inquiry process that 50-100 EJ of sustainable biomass could become available each year by 2050 is in contradiction with part of the literature (but in line with another part). For example, Harper et al. (2018) note that “there is high agreement from previous literature that 100 EJ/yr of bioenergy could be produced sustainably, and moderate agreement that this can increase to 100–300 EJ/yr.”