Work Group #4: Sustainable Marine Fuels

Deliverable 3.1 Report Review Template

1. Report title	**The Potential and Challenges of Drop-in Biofuels**
2. Publication date	July 2014
3. Author	Karatzos, Sergios (University of British Columbia, Canada) James D. McMillan (National Renewable Energy Laboratory, USA) Jack N. Saddler (University of British Columbia, Canada) Report by IEA Bioenergy Task 39.
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)	Aim of the IEA Bioenergy Task 39 working group is to facilitate the commercialization of conventional and advanced transport biofuels from biomass and other renewable feedstocks. 15 countries, amongst which Canada and the US, collaborate in this working group. The report is published by IEA Bioenergy and IEA Energy Technology Network.
6. Length (pages)	203

7. Link (or where to get if not available online)	https://sustainableworldports.org/wp-content/uploads/Karatzos-et-al._2014_The-Potential-and-Challenges-of-Drop-in-Biofuels-report.pdf
8. Sector coverage	Transport sector in general; shipping is not discussed in particular.
9. Main aim of the study	• To describe and assess alternative technical processes for the production of drop-in biofuels. • To provide an overview of anticipated challenges in large-scale commercialization of drop-in biofuels. • *Scope: global.*
10. Methodology	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?*	Methods to produce drop-in biofuels (liquid bio-hydrocarbons that are functionally equivalent to petroleum fuels and are fully compatible with existing petroleum infrastructure), using: • oleochemical processes • thermochemical processes • biochemical processes • a combination of these (“hybrid” processes) *The alternative technical processes and subprocesses are described in great detail.*
12. What are the main conclusions from the report?	• Despite tremendous technical progress and commercialization over the past years, only relatively small amounts of drop-in biofuels are commercially available today. • It is likely that oleochemical derived drop-in biofuels will initially be used to establish the markets and procedures for use of drop-in biofuels. However, significant expansion of oleochemical systems will be limited by the cost, availability and sustainability of food grade (vegetable oil) or animal oil/fat based feedstocks. • Thermochemical technologies are well positioned to account for a considerable component of drop-in biofuel capacity growth over the near-to-midterm.

	• Biochemical and hybrid based drop-in biofuel processes typically provide lower yields of higher value intermediate products (which can be used to produce biofuels). • For all of these technologies, hydrogen sourcing will play a major role in future commercialization of drop-in biofuel systems. (Large amounts of hydrogen will be needed.)
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	Drop-in biofuels, in specific: • Ethanol – *Description of past production volumes, country biofuel policies, compatibility with automobile vehicle engines. Long description of production methods.* • Biodiesel (FAME) - *Description of past production volumes, country biofuel policies, compatibility with automobile vehicle engines. Long description of production methods.* • HEFA biofuels (drop-in biofuels produced by hydrotreatment of lipids from fats; also called HVO) – S*hort description of properties such as oxygen content, specific gravity, sulphur content, specific energy and aromatics content. Long description of production methods.*
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)	Not considered.
15. Does the report consider exhaust emissions only, or life-cycle, or both (or some other range of emissions)?	Not 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.	Not determined.

17. Does the report discuss barriers and opportunities for ships 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?	Not discussed.
18. Does the report discuss barriers and opportunities for ports 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?	Not discussed.
19. Does the report include capital and operating cost estimates for the ship and/or land-side?	Not discussed. Some estimates of feedstock costs, capital costs of facilities and production costs are given within the descriptions of the biofuel production processes.
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)* • External Safety Readiness Level of the system - *Estimated maturity of the risk mitigations for bunker operations (on a scale of 1-9)*	Not discussed in this way. The report does not take a fuels perspective, but a production methods perspective. Some commercialisation efforts by particular companies and for particular production route-fuel combinations are shortly described.
21. Are the fuels suitable for short and/or long (trans-oceanic) voyages?	The report mentions that drop-in biofuels are better suited for long-distance and non-electrifiable transportation modes such as marine shipping, but no elaboration is given.

22. Does the report identify/discuss potential issues around community acceptance for this fuel, or potential social/community impacts associated with the system?	Not discussed.