

Prospects for renewable marine fuels

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Introduction

In order to reduce the environmental and climate impact of shipping, in the short and long term, the introduction of alternative fuels is required. However, there is a need for more knowledge on alternative marine fuels. For example, what is the potential role of biofuels as marine fuels?

Aim: The aim of the study is to assess the prospect of renewable fuels in the shipping sector by conducting a multi-criteria decision analysis of selected alternative fuels with a panel of shipping sector related stakeholders. The Analytic Hierarchy Process is used.

The alternative marine fuels assessed in this study include:

- liquefied natural gas (LNG),
- methanol produced from natural gas (NG-MeOH),
- methanol produced from biomass (Bio-MeOH), and
- hydrogen produced from electrolysis (Elec-H2).

The sustainability perspectives and criteria included in the assessment is illustrated in Figure 1.

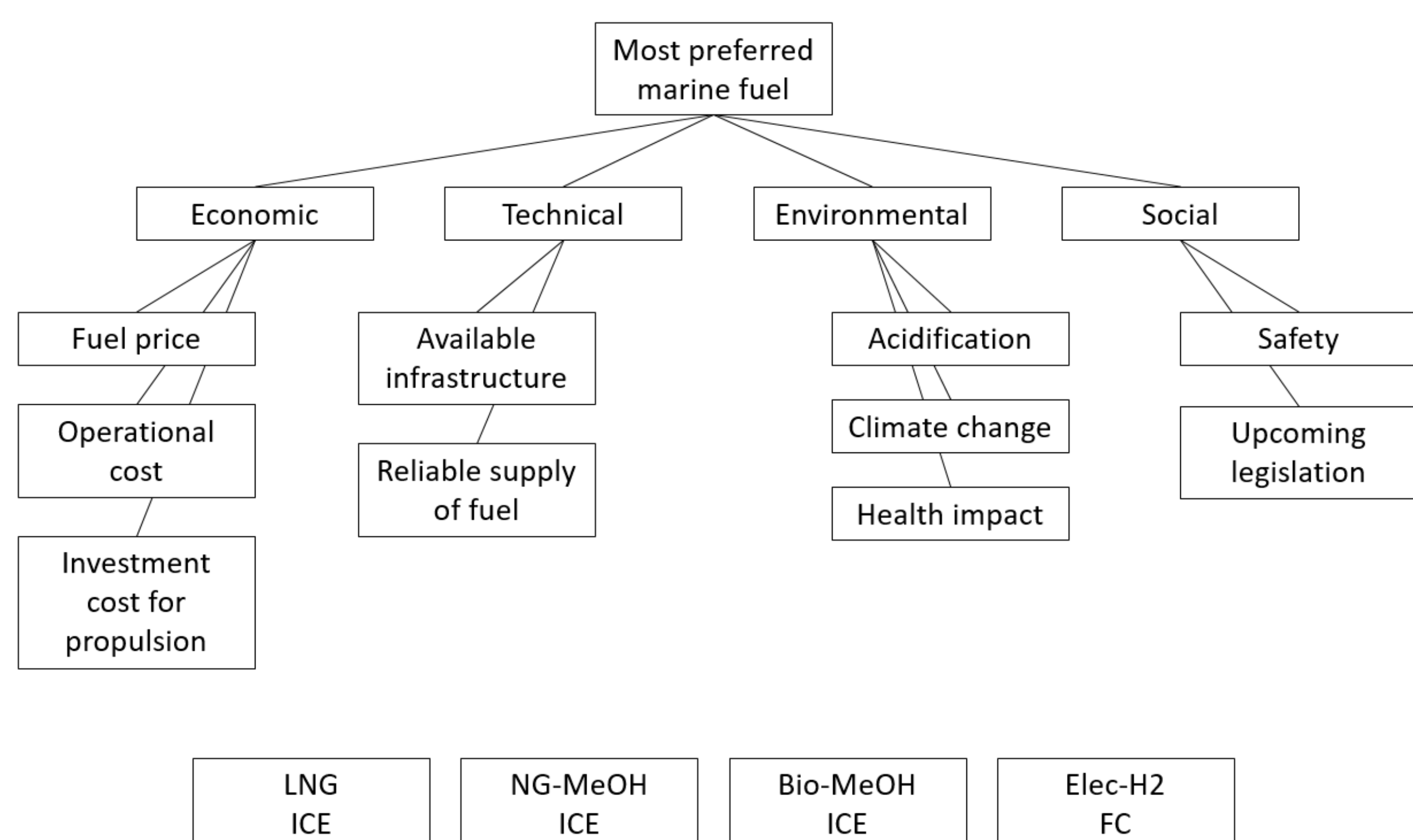


Figure 1. Hierarchy tree of the decision problem when selecting the most preferred alternative marine fuel. Fuel and propulsion technologies: liquefied natural gas (LNG), natural gas based methanol (NG-MeOH), biomass based methanol (Bio-MeOH), hydrogen (Elec-H2), internal combustion engine, and fuel cells.

Results – ranking of alternative marine fuels

The possible impacts of the alternatives marine fuels with regards to all the included criteria were assessed and scored based on a literature review. The panel of stakeholders performed pairwise comparisons of the sustainability perspectives and criteria included, which then were weighted according to the stakeholders' values and preferences.

Jointly the stakeholders valued economic criteria highest, followed by social criteria, environmental criteria and technical criteria. The most preferred fuel from the joint stakeholder scoring was electrolytic hydrogen with fuel cells, followed by biomass based methanol and LNG (equally preferred), see Figure 2.

The ranking of alternative fuels differ somewhat between the four different stakeholder groups included (see Figure 2). Hydrogen and LNG is the most preferred fuel for all groups and natural gas based methanol the least preferred except for the ship owners. However, the potential role of biofuels as marine fuels need to be further investigated.

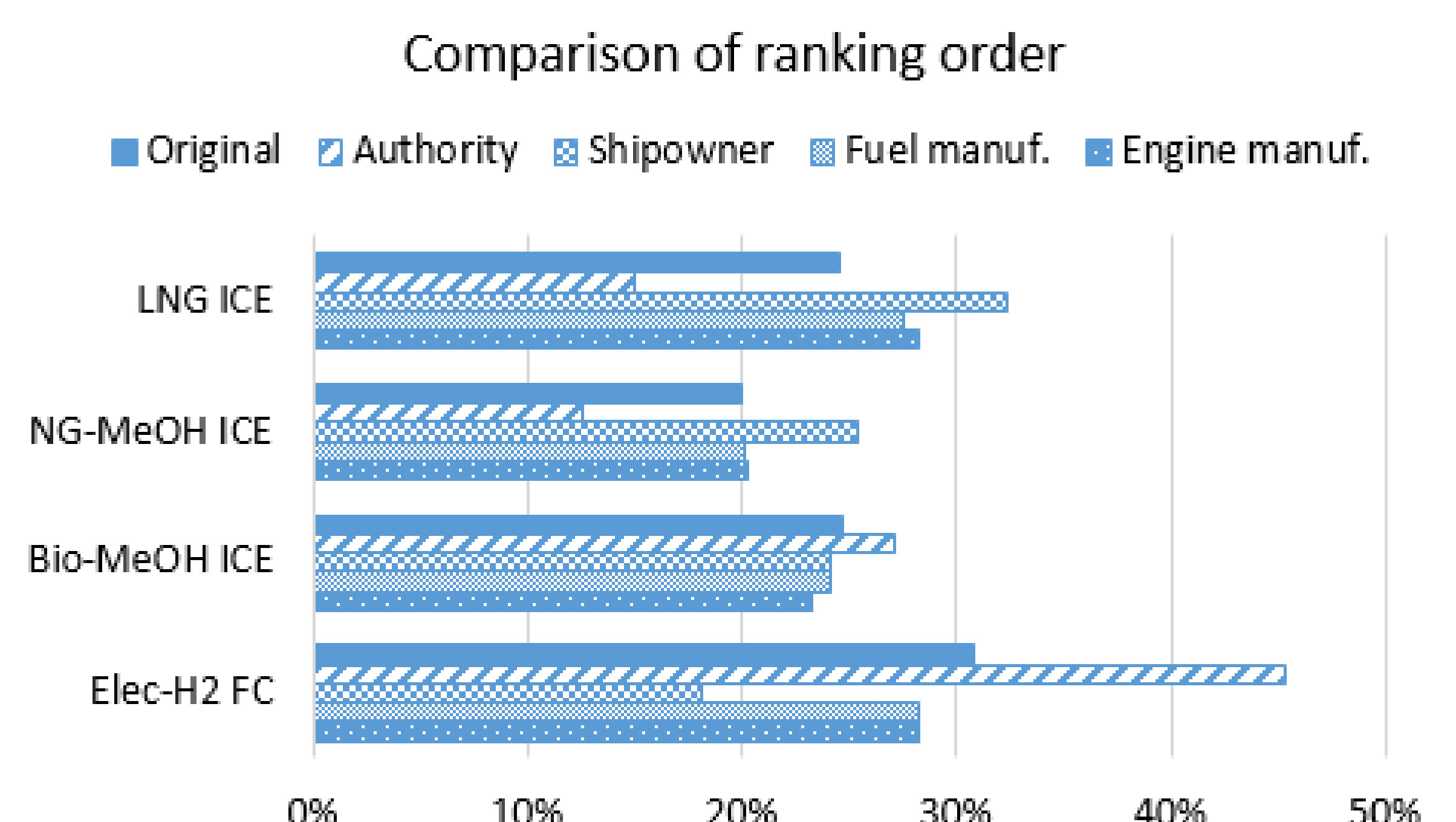


Figure 2. Comparison of the joint (original) ranking order of alternative marine fuels and the ranking from different stakeholder groups representing authority, ship owners, fuel manufacturer and engine manufacturer.

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