

Alternative Fuels for International Shipping - Some  
Guidance and Background for Today's Decision Making  
**GMW-C 2020 "Fact Book"**

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# Chapter 1

## Preamble

Today we are discussing all kinds of "Power to X" (PtX) fuels as ship fuels and include non hydrocarbons like Ammonia and Hydrogen itself in this picture. This report is intended to give some information for decision making on investments today by explaining some of the most relevant facts on fuels from water electricity, carbon, oxygen, nitrogen which are called PtX-fuels. Also some facts related to the judgement on the speed of change by explaining the necessary efforts are given. The author sees his report as a **"fact book"**.

Remains the question: Why should a small consultant company like GMW Consultancy should be able to give any advise beyond the information given e.g. by DNV GL's ETO[13] or the 2018 and 2019 published "Assessment on Alternative Fuels" from the same company [11]. The latter easily can be answer: It is because I did major contributions to the content, scope and layout of the publication [11]. The contribution was based on some know how gained over the years of professional life.

On 04.09.2018 I was cited by Robert Wright in the Financial Times<sup>1</sup> as follows: *"I think in the long run shipping and aircraft are the only things that need large quantities of energy-dense liquid fuels," says Gerd-Michael Würsig, the organisation's<sup>2</sup> business director for LNG ships. "Shipping and aircraft will run on hydrocarbons even in 200 years."* He had not added the second part of the explanation. It was explained that any molecule consisting of carbon and hydrogen is a hydrocarbon and that shipping in 100 years may not run on fossil hydrocarbons any more but on hydrocarbons<sup>3</sup>. For shipping this statement was and is related to deep sea shipping.

For aviation the explanation from 2018 is now common sense. After reading this publication the interested reader may judge on her/his own if the judgement for shipping has also the potential to become common sense.

Personally the topic "alternative fuels in shipping" accompanies my professional life since the studies at Hannover University in the 80s. It was my later doctoral advisor, Prof. Gietzelt, who gave me in 1986 the task to evaluate wind energy as a future source for electrical power generation. This was within the scope of a presentation at the university. At that time wind power turbines had 50 to 300 kW

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<sup>1</sup>it is not known if this link still works, but it worked at least on 09.07.2020: <https://www.ft.com/content/016c1a64-7f9b-11e8-af48-190d103e32a4>

<sup>2</sup>I was Business Director alternative Fuels at DNV GL at that time.

<sup>3</sup>The missing second part resulted in some confusion of people with a very basic know how about the subject and no idea about chemistry.

power output<sup>4</sup> and I was very enthusiastic about this power source. The only not so promising thing were the "expert predictions" how many turbines must be installed and how Northern Germany will look like afterwards. Today Northern Germany nearly looks like predicted at that time and still the proposals are to increase the wind power on shore in Germany by the factor of 4 to 6 (e.g. [10]). After reading Chapter 6, the reader may judge on her/his own how useful this is

Later in the 80s my line manager in Germanischer Lloyd, Dr. Krapp, gave me the task to evaluate the possible import of liquefied hydrogen to Germany. This turned out to be a long term project which occupied a lot of my work force between 1989 to 1996. Of course also other projects needed attention. E.g. things like engineering consultancy of ship owners and industry partners who e.g. had problems with scavenge air coolers or screw pumps in south American power plant installations.

A summary of the Hydrogen projects with GL involvement is given in [5]. The tables and illustrations may also be of interest for readers who are not able to read German text. By the way, the same is valid for the most fact finding publication on hydrogen production and transport written by Dr Manfred Schüle [6], which is today completely unknown. May be because it was published in the stone age of the internet. Anyhow, for the later publication also some thoughts in English are available [8].

It might have been a joint idea from Dr. Krapp, Prof. Gütschow<sup>5</sup> and Prof. Gietzelt to give me the topic on liquefied hydrogen transport which finally formed the base for my doctoral degree from Hannover University [7].

Hydrogen and PtX fuels disappeared from the agenda for decades mainly for commercial reasons and my professional life was related to other things after 1996. Anyhow, the know-how on liquefied gases were the base for my work with liquefied gas carriers and the IMO IGC-Code including the revision of this Code by SIGTTO in 2008 to 2010. The alternative fuels for shipping came back in the form of LNG as ship fuel in 2004 when I started to consult the German Ministry of Transport at IMO for the IGF-Code development.

All the above may have motivated the DNV top Managers Henrik O. Madsen and Tor E. Svensen to ask me to join DNV as "Business Director for LNG as ship fuel"<sup>6</sup>. Now, at the final part of professional career and working on my own, the topic from the early part is mainstream and comes back to the world community but often lacking an understanding of the underlying technical and economical basis in society, politics and industry. Most work published for the wider public is motivated by particular interests for politics, selling products or raising funds for research. This is to some extent even true for information on the topic as it is given in shipping by the class societies and system suppliers.

To get an idea what you may expect from this report you may download the "Future Fuels in Shipping – Opportunities and Costs"[39] from the GMW Consultancy web page (<https://www.GMW-Consultancy.com>) or read the STG-Jahrbuch 2019. Of course this report here goes far beyond the scope of [39]. What you can expect

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<sup>4</sup>today 4,5 to 8 MW are the state of the art

<sup>5</sup>CEO of Germanischer Lloyd at that time

<sup>6</sup>what I did in early 2012



from this report is an explanation of the most relevant facts on types and cost limits for alternative fuels in shipping, a background about the scope of the problem to get a serious carbon reduction in the world, some relevant highlights of IMO legislation including the view to Methane slip, some information about the relevance of ship types for  $CO_2$  reduction and finally a view towards the KPIs for the fuels of the future and an outlook what may happen within this and the next decades.

It is not the aim of this report to detail the legislative boundaries related to IMO rule making, climate debate in UN in general or to give a new, final and 200 % true scenario for the sustainable world. The aim is to help the reader in making up her/his own mind.

## Chapter 2

# Aim and ambition of this report

For a long time the question what will be the future fuel in shipping has been answered with: "heavy fuel oil and may be some gas oil". Within recent years it became obvious that this answer is outdated. Emission reduction in general and especially the world wide aim to reduce greenhouse gases have reached shipping. A number of proposals are heavily discussed. All discussions include the change to low carbon or even no carbon fuels. Will the new fuel be Hydrogen, Methane, Ammonia or something completely different?

The technical background about fuel options and an overview of the likely fuel and technology solutions have been done e.g. in the white paper "Assessment of Selected Alternative Fuels and Technologies" which has e.g. been published in [11]. This report goes beyond these data. The focus is on information to enable answers of the three questions:

- Is there a need to change the complete infrastructure and propulsion technology in shipping by introducing complete new fuels?
- What is the relevance of the "fuel question" for current investment decisions in shipping?
- How much the "future fuels" will cost and how far away is the "future"?

A lot of experts are providing answers to these key questions. In most cases they have a special view and interest driving the answers.

Written by an independent senior consultant this publication aims to highlight basic relations and facts by bringing some light into the "pros and cons" of different fuels currently discussed and the necessary background related to the stipulated overall aim of the world community to reduce the fossil based  $CO_2$  footprint of mankind drastically in a very short period of time. The evaluations include the costs which have to be expected to come forward on this way.