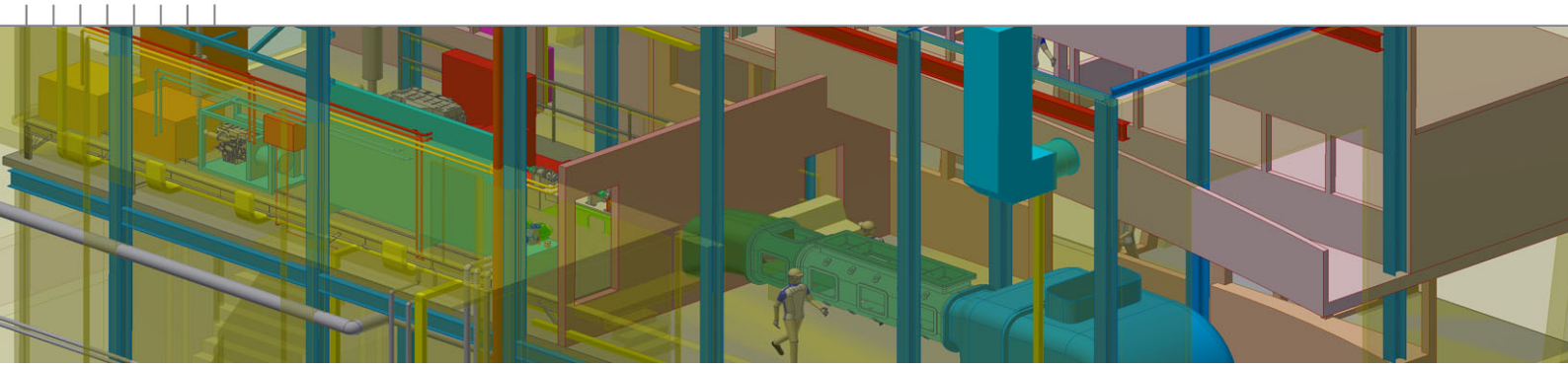


Ship Power and Energy Concepts

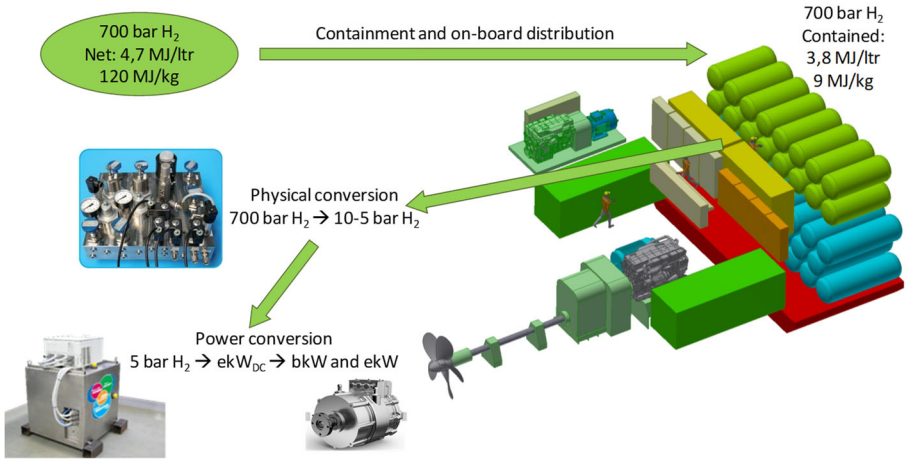
SPEC, our conceptual design method, supports ship owners, designers and operators to define optimal power systems for ships with clean energy

Due to environmental awareness and ever tighter regulations, the maritime world faces an enormous challenge to change from fossil fuels to energy sources that cause minimal emission of greenhouse gasses as well as harmful gasses (NOx, SOx) and particle matter. The impact of this transition to cleaner power sources goes much further than simply replacing the old diesel engine with a modernised one. A multitude of alternative energy sources can be considered, as well as the equipment to convert them into useable power. Beside financial effects, the consequences, however, reach as far as new propulsions arrangements, changes for fuel storage, crew capabilities, necessary shore infrastructure and public support.

Ship Power & Energy Concepts

Information about alternative power is available from publications and exhibitions, conferences and symposia. For some applications vendors do offer commercial solutions, others are still very experimental. A clear picture is hard to get because information is often fragmented and offers a confusing perspective. This makes choosing the optimal technology for specific maritime operations a difficult task, and implementing the consequences in the ship design a complicated challenge.

New energy carriers – From energy to power in shipping



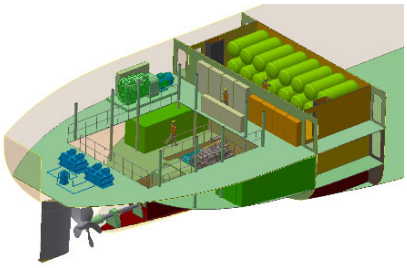
Compared to fossil fuels alternative energy carriers have several different properties. Therefore, the complete energy and power chain from tank to propulsion has to be designed outside the conventional framework.

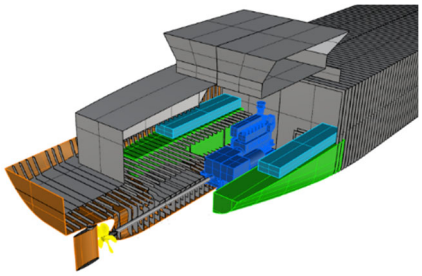
Hydro Systems Integration

The transition from conventional propulsion and power systems powered by fossil fuels to future systems that do not produce any harmful emissions requires knowledge about the behaviour and control of these systems. Therefore, MARIN is setting up a test environment for digital and physical research on 'Hydro Systems Integration'. This will enable and support the marine sector to implement clean power systems.

What benefits do MARIN's SPEC based services offer decision makers in ship design?

- An overview of alternative solutions and their properties, vendor-independent and considering the complete optimised system.
- Insight in the consequences of design choices and priorities for the operation and the size and lay-out of the ship.
- A conceptual design and layout of the power and propulsion systems including bunker storage which can be used for further design.
- Clear information enabling a responsible choice for the optimal power concept for specific operations.



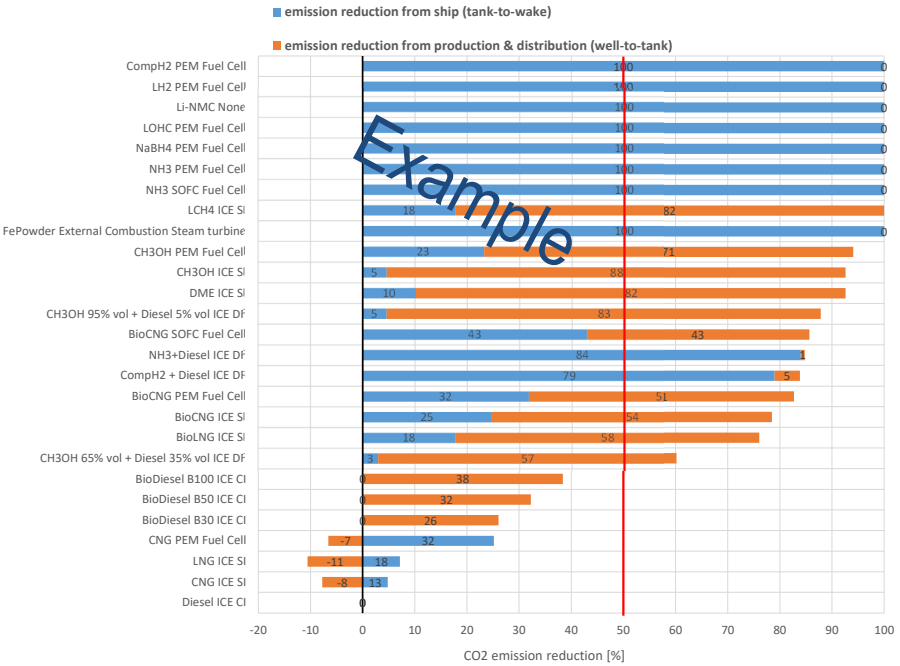


The variety of possible energy carriers, the power conversions and the appropriate propulsion and power configurations require a holistic conceptual design method. This is why MARIN has developed the SPEC method.

Starting point for SPEC are the operational requirements of the ship as well as criteria, objectives and priorities of the owner. A database with properties of all sorts of energy sources, its equipment and storage requirements is used. From here SPEC first starts with a pre-selection to disregarded solutions which do not (at all) fulfil the objective. A multi-criteria ranking can be performed, based on weighing factors for operations and investments. Alternatively, a selection purely on system size or weight can be made using a Ragone chart. The tool does not have an algorithm to determine the 'right' solution. The process is an exploration, which requires involvement of the ship owners at various stages, to provide requirements and preferences.

The criteria cover all sorts of technical, economic, environmental and societal aspects. Initial effects during design and building are considered, as well as long term effects during operations.

By changing the scores and weights of the criteria, future estimates can be made using multiple scenarios for the maritime energy transition. The output of SPEC is an independent, future proof and operations based ranking of a wide selection of solutions.



For the most attractive solutions a more detailed analysis is performed. How do the effects of such a solution reflect on the ship design? Will it have to be larger, will it require more power? For this analysis we use iterative calculations and typical design coefficients. To come to a potential solution, a concept lay-out can be developed, including the major systems that would be required. This can support proper integration with the ship hull design and its future operations.

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