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Hybrid system virtualisation for predicting performance and eliminating risks and uncertainties

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Nowadays, the topic of hybrid marine energy systems is becoming increasingly relevant – this trend is mostly driven by the constant demand for safer and more efficient powertrains while being further accelerated by initiatives like zero-emission shipping, the initial IMO GHG 2050 strategy or such instruments as EEDI, EEXI or CII.
In this respect, the present study focuses on the domain of ocean-going vessels propelled by large 2-stroke marine engines and, in particular, on the challenges of a properly integrated propulsion system. Virtualising the integrated system, using transient-capable components models provides plausible quantitative figures about its performance and enables informed decisions at early stage. To this end, the paper highlights two findings – first, the importance of component "rightsizing" and, second, the necessity for intelligent operation of those components. Embarking on an analysis of a wide range of customer studies for various vessel types (PCTC, Container, LNGC, etc.) it is demonstrated how each use case may lead to another optimal solution. For instance, utilizing the power-take-off (PTO) functionality for genset replacement might be generally feasible but its efficacy, due to the interaction of main engine and shaft generator, depends highly on the intended vessel operation. Another example is the arguably inefficient peak shaving functionality which, if only applied in a suitable situation (e.g. for genset load balancing), still may provide benefit to the overall system efficiency. The paper remarks the importance of a virtual tool to support the hybridisation of marine vessels. Such tool allows for the identification of potential risks and criticalities in a very early stage as well as for reduction of calibration effort and risk of failure during commissioning.

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