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A mixed AC/DC low voltage electrical distribution architecture for increasing the payload on ships

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This paper presents the development of a novel architecture for the low voltage electrical distribution on board using a mixed AC/DC approach. The design of the proposed solution is based on a real-world case study, i.e. the electrical distribution grid of a main vertical zone of a large cruise ship. The new electrical architecture is designed with the aim of obtaining a gradual transition toward a totally DC electrical distribution grid on-board. Furthermore, according to the selected technical criteria, the proposed scheme can be implemented on a real ship by using devices either available in the market or easily adaptable from commercial items. The impact of the proposed electrical design on technical volumes and weights of the electrical equipment is evaluated in comparison with the existing solution. Such a comparison shows that the proposed scheme allows a reduction of electrical plant volume and weight of about 30%. Finally, it is worth noting that the presence of several power electronic converters in the proposed electrical architecture increases the level of flexibility and controllability of electrical power flows on board representing a fundamental step in the transition toward a paradigm of smart electrical distribution and utilization in ships.

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