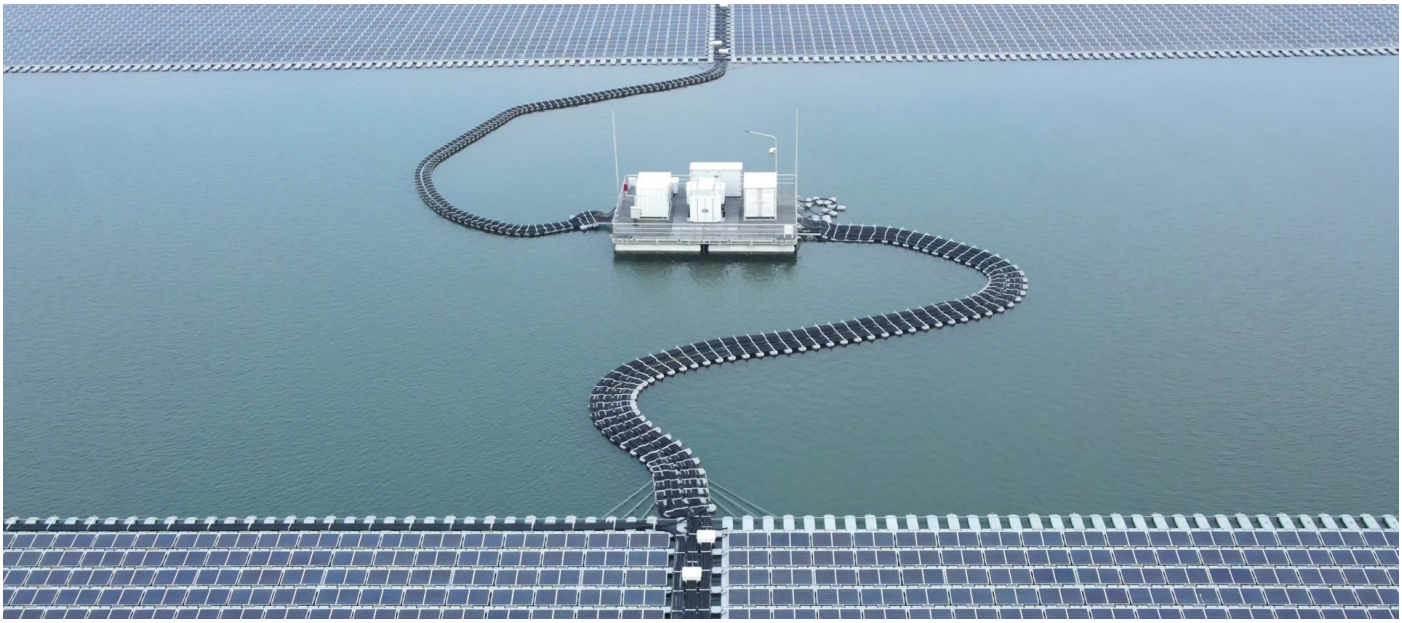
Safe Electrification of Shipping and Battery Storage in Marine Applications

DUKOSI BLOG | Published: 10 Dec 2024

The electrification of marine applications, including marine vehicles such as ships or other transportation methods, as well as newer innovations like submerged data centers and offshore battery storage, will make battery storage anything from a valuable asset to an essential part of the design.



Electrification of Shipping

In 2022, the OECD estimated that global CO2 emissions from the shipping industry amounted to 858 million tonnes, 16% higher than those from air transport[1].

In order to achieve net zero emissions, marine transportation such as short logistics to long-haul shipping, and regular transportation routes operating in sea channels, harbors, rivers, and fjords can all benefit from transitioning to electrification; in Europe alone, around 900 ferries operate in this manner. This offers significant improvements to commercial operational efficiency, and eliminates contributions to local air pollution[2].

Dubbed "the Tesla of the seas", the world's first electric cargo ship, the Yara Birkeland, has a 7 MWh battery, which is charged by renewable sources. While the ship itself cost about three times more than a version using conventional fuel—partly due to it being among the first of its kind—it reduced Yara's operating expenses by 90%[3].

Power Generation & Static Commercial Activities

For offshore power generation, such as wind or tidal applications, battery energy storage can provide a local buffer to smooth out power provision to the grid.

In other commercial marine activities, where interruptions in power supply can be dangerous, battery energy storage is an essential asset for ensuring safe, continuous operation. For these applications, containerized energy storage systems are an ideal, self-contained battery solution.

Improving the Performance, Safety, and Reliability of Batteries

You don't have to be an engineer to experience a hesitant reaction to mixing electricity and water, therefore battery safety and reliability are of paramount concern, and each marine application presents their own unique challenges. A successful design must also adhere to regulatory compliance while balancing the usual development caveats; whether re-engineering an existing design or starting a new one to meet the requirements of these unique applications, every opportunity benefits from an inherently safe, reliable, and flexible architecture, while also being technologically advanced to ensure it achieves optimum performance and longevity.

This is where Dukosi excels. The Dukosi Cell Monitoring System (DKCMS) is specifically designed from the ground up for high capacity, high performance batteries, delivering enhanced safety and reliability beyond competing battery architectures.

Safety

DKCMS achieves unprecedented insights into the battery's internal workings, accurately relaying every cell's operational temperature and voltage synchronously to the BMS with deterministic latency. This is superior to alternative architectures that incorporate only a few temperature sensors per module. With constant monitoring of each cell's state, overtemperature events can be captured immediately and the BMS processor alerted, even if it's in a hibernation state.

To further support battery development for marine applications, DKCMS can assist in achieving regulatory compliance, such as IEC 62619:2022. For stringent DNV safety standards, Dukosi technology can streamline platform-level compliance, reducing development costs and accelerating time to market.

Reliability

DKCMS significantly reduces OPEX over the lifetime of the vessel or BESS deployment by enabling reliability gains in several areas. Its novel, contactless architecture is intrinsically isolated and can deliver up to 2x better reliability than typical wired designs as it entirely removes the need for wiring harnesses, pins and connectors that are frequently points of failure or short-circuit.

Cell level temperature sensing provides precise detection of weaker cells, which can trigger preventative maintenance, while more accurate voltage sensing (TME) provides better data for SoC and SoH calculations, which are more valuable the longer the battery is in service.

Performance

More accurate SoC estimations allow more usable energy to be extracted from each cell in confidence, which is a monetizable asset for energy storage operators, or extends the range of electrified vehicles. Per-cell temperature measurements also enable more efficient faster charging as the pack status can be more precisely controlled through both pre-conditioning and during the charge session, accelerating turn-around time.

Case Study: Dukosi x Nordic Marine Power

Recently, Dukosi collaborated with Nordic Marine Power (NMP), an energy storage specialist for the marine industry, to develop a new battery pack design that aims to set a new standard for marine battery safety.

As part of the development effort the teams committed to a live experiment that analyzed the effects of heat propagation in a cell module. The experiment involved eight prismatic lithium-ion cells packaged as a contiguous block, typical of a marine application, with real-time monitoring of voltages and temperatures recorded during an induced over-power scenario.

Download the case study (PDF)

Enhancing Battery Reliability Through A Multitude of Technical Advancements

In many other ways, the Dukosi solution enhances reliability as well. The Cell Monitors are typically placed closer to the cell terminals with minimal and consistent sense lead lengths, enabling them to record highly accurate and synchronised voltage data—an essential factor in State of Charge (SoC) and State of Health (SoH) estimates[4]. Dukosi's C-SynQ® [5] technology communicates synchronous cell data through a unique near field network with deterministic latency, ensuring consistent readings and improving data accuracy, even during sudden voltage transients in the battery.

In addition, by reducing the battery-wide component count by up to 10x compared to a typical wired architecture, the Dukosi solution eliminates potential points of failure and improves reliability by up to 2x — another advantage of its 'contactless' near field connectivity[6].

Discover more about the Dukosi Cell Monitoring System, and contact Dukosi to understand how our innovative battery architecture can enhance your next-generation commercial, industrial or energy storage application in marine environments.

1. https://one.oecd.org/document/SDD/DOC(2023)4/en/pdf

2. https://www.electrive.com/2024/10/30/stockholm-welcomes-the-worlds-first-electric-powered-hydrofoil-ferry/

3. https://www.sustainable-ships.org/stories/2021/worlds-first-electric-cargo

4. https://www.dukosi.com/blog/sensitivity-of-lithium-ion-battery-soc-and-soh-estimates-to-sensor-measurement-error-and-latency

5. https://www.dukosi.com/blog/what-is-dukosis-c-synq

6. https://www.dukosi.com/blog/white-paper-wired-wireless-and-contactless-comparing-bms-design-approaches