



## SUCCESS STORY

# Zero-emission harbor buses in Copenhagen

The Danish capital Copenhagen aims to become climate neutral. A new fleet of electric harbor buses transports passengers around the city and are charged by Stäubli's QCC in as little as 6 minutes.

The Danish capital Copenhagen is not only reputed to be the happiest in the world, it also aims to become one of the first climate neutral cities in the world. This ambitious goal requires action throughout the city, especially in transportation. A new fleet of electric harbor buses transports passengers across the iconic sea front and is automatically charged during stops. With Stäubli's Quick Charging Connector, charging cycles of just 6 minutes can be realized in the challenging harbor environment to support the city on its way to a zero-emission future.

### Ambitious climate goals

The waterfront and harbor are probably the

most iconic thing about Copenhagen. Running through the middle of the city and separating most of the city center from Christianshavn and Amager, the clean harbor is not only a beautiful sight, but also a body of water where many Copenhageners enjoy swimming, kayaking and boating. The city relies heavily on its waterways as part of its public transportation system, where ferries known as harbor buses transport pedestrians and tourists across eleven stops between the Royal Library, Nyhavn, Opera, the Little Mermaid Statue and Refshaleøen in Copenhagen. Within the next decade, Copenhagen has major climate ambitions, and aims to be the first climate neutral capital.

**QCC:** Connection device for automated high-power charging

#### Application:

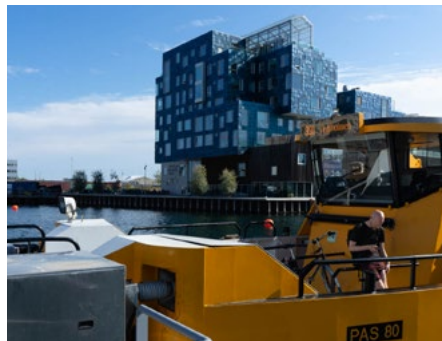
- Completely touch-protected and fully automated.
- Waterproof and resistant to harsh environment.
- Designed for high numbers of mating cycles.

**STÄUBLI**





Stäubli's QCC quick charging solution allows the vessels to recharge in as little as six minutes without disrupting their schedule.



To achieve this goal, the City Council adopted the ambitious CPH Climate Plan 2025 in 2012, which includes mobility as one of its four pillars. To achieve the goals of this pillar, the city set aside funds to help cut emissions on the existing diesel-powered harbor buses.

#### A multinational project

Damen Shipyards Group, a family-owned business from the Netherlands with a longstanding history in maritime solutions, signed a contract with Arriva Denmark for seven fully electric ferries. As a multinational leader in European public transport and part of DB-Group, Arriva operates these ferries for Movia, the public transport authority of Copenhagen, Denmark. The newly developed vessels are based on Damen's E3 ferries and are designed to be environmentally friendly, efficient in operation and economically viable. For the charging stations, Damen onboarded the young but experienced Heliox as a specialist providing

a complete range for a made-to-measure charging solutions, regardless of fleet size or requirements in charging performance and time. With its vision of "Powering a sustainable world for future generations," Heliox fit nicely into the engineering project.

#### Demanding harbor environment

In order to support the city's ambitious climate goals, the local transport company Movia requested a cleaner, greener operation of the vessels. Searching for the best possible solution, Damen engineers considered three different solutions to realize the propulsion: biodiesel engines, hybrid vessels with generators on board and fully electric solutions. Ultimately going full-on battery electric was the optimal choice for the planned 12-year operation of the ferries: zero emissions, quiet operation and highly maintenance friendly. As the vessels are planned to dock bow-first, a drive-on charging system was targeted. Damen engineers created an automated charging system, allowing the vessel

to drive up to the charging pin bow-first for a fully automated connection, coupled with fast-charging to replenish the battery power in around six minutes. This concept required an innovative and reliable charging solution that can withstand the rough conditions in the harbor environment.

#### The solution

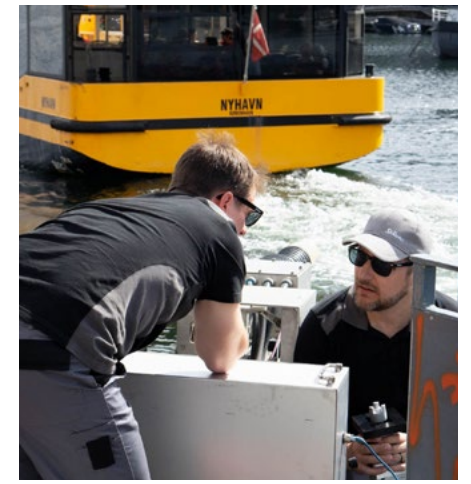
Engineered for heavy duty applications in autonomous charging, Stäubli's QCC quick charging connector was the perfect fit for the demanding conditions in Copenhagen. To ensure highest performance and a faultless connection of the connector and the vessels in the moving water, Stäubli engineers had to adapt the QCC system for harbor docking applications. While the QCC is designed to absorb both angular and positional misalignment, adaptations had to be made to the motor and software to guarantee uninterrupted connection during axial movement of the ferry in heavy waves. The QCC system is protected from dust and low-pressure water jets from any direction (IP55) as well as touch protected (IP2X). To make it ideally suited to the challenging conditions in the harbor environment, an additional housing was designed to protect the system from the elements, especially salt water.

#### Customer benefits

Combining a fast-charging system with Stäubli's QCC solution and a small battery pack allows the vessels to recharge in as little as six minutes without disrupting their

schedule. Due to the almost fully autonomous operation, captains simply press a button in the cockpit to start the charging process and do not have to leave the vessel or manually plug in a connector. Overall, the QCC system with its high-power transfer in minimal time supports productivity and short stops across the three charging locations and offers highest reliability and efficiency due to the resistance to harsh environments and the unique properties of Stäubli's MUL-TILAM contact technology.

Throughout the project, Stäubli engineering experts supported Damen and Heliox in the design and integration of the QCC into the vessel and infrastructure and later on the implementation to deliver a safe and dependable, high power charging solution for the new harbor buses. Going the route of battery electric harbor buses has many more advantages than just helping the city reach its ambitious climate goals. By reducing noise and emissions, passengers and pedestrians on and off the harbor buses benefit from a quiet and unpolluted journey across the stunning waterfront of Copenhagen.



#### Customer benefits

- High level of safety.
- Reliable operation, low-maintenance and a long service life without loss of performance.
- Fast and fully automated high voltage and high current charging process for increased efficiency.

#### About Stäubli

Stäubli is a global mechatronics solution provider with three core activities: Connectors, Robotics and Textile. The international Group has a presence in 29 countries.

Stäubli Electrical Connectors is a specialist for advanced contact technology and technically mature solutions with a product portfolio ranging from miniature connectors up to high-power connectors for various industries.

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