

# ALL-ELECTRIC SUPPLY VESSEL

The City Council of Utrecht is going to deploy a low emission vessel for supplying shops, restaurants and bars located on the canal banks of the city centre. The vessel will be equipped with an all-electric propulsion system fed by batteries, in order to operate with low levels of emission and noise. In September 2007 Vuyk Engineering Rotterdam was commissioned to make the design. The vessel almost immediately received the project name "bierboot" (beer boat).

The new vessel will operate along with the current vessel, which is an altered open-top, pram-shaped barge driven by a diesel engine. The current vessel was the basis for the new design. We suggested exploring an all-electric version, because of the environmental benefits. This innovative solution has proven itself through use in canal tour boats.

The final design is optimized for use in Utrecht city centre with its typical low bridges and quays. Furthermore the city's canal tour boats need enough space to pass by when the vessel is moored along the quay. The complete vessel has to be able to be handled safely by one person. And last but not least it needs to transport as much cargo as possible.

The vessel is a steel river vessel with a long open cargo hold for the transport of wheeled containers. The dimensions of the vessel are 18.8 x 4.26 x 1.10 m. The hull is a hard chine design with inclined sides to avoid bottom damage by drain pipes, which can stick out about half a meter from the quay. A wide skeg is fitted under the fore ship and equipped with a bowthruster for manoeuvrability. The skeg is part of a straight bow to allow for pushing pontoons with a low freeboard. The bow and stern side of the vessel are shaped to simplify turning away from the quays. Three bulkheads divide the vessel into four watertight compartments.

The cargo area is suited to carry 40-48 wheeled containers of max. 600 kg each, depending on the size. The containers are loaded and unloaded with an electro-hydraulic crane with knuckle boom which is fitted on the fore deck. The reach of the crane is 14 meters, which allows the cargo to be delivered at wharf level as well as at quay level.

The propulsion installation consist of a 750 mm fixed propeller, driven by a 55 kW, 400 V AC electro motor which in its turn is driven via a frequency controller. The input is supplied by four sets of traction batteries supplying 480 V DC total. Each set contains 60 2V cells. Two sets of batteries are located in the fore peak and the other two just behind the collision bulkhead. The capacity of the batteries has been determined on the basis of the operational profile of the current vessel. A design requirement was that the vessel would be able to operate for a full day, also using the crane, without recharging the batteries. The batteries are charged during the night via a shore connection; charging is possible in ten hours. If needed, the vessel can be driven by an emergency generator set.

Before the tender phase, the vessel's environmental friendliness was studied extensively by Ecofys. The vessel's emission is almost zero when using green energy. In comparison with supply by delivery van, the CO<sub>2</sub> emission will be reduced by 94%, fine dust by 98% and NOx will be reduced to almost nil.

Traffic congestion in the city centre will be reduced further because delivery vans and trucks will be used less. Other benefits are reduced traffic noise and less damage to wharf basements and bridges caused by road traffic.



We assisted the City Council with contracting out the vessel. The combination of shipyard Boxce and Koeleman Electro received the order for the construction of the vessel. Vuyk Engineering Rotterdam received the order for building supervision as well. The vessel is expected to be delivered at the end of this year.

This vessel is not the smallest vessel we have ever designed: that credit goes to a nine-meter vessel for the Maritime Museum in Rotterdam, used to transport passengers in the harbour. However, this project raised warm feelings among the staff and many applied spontaneously for the trials (in Dutch 'proeftocht'). Whether this is because of the innovative nature of the vessel or due to the attraction of the café's in Utrecht is unknown.

