HARNESSING THE POWER OF electricity

Leo Hambro, Commercial Director, Tidal Transit, addresses the current state of the offshore wind servicing industry and highlights solutions for sustainably transitioning the sector to net zero.

Offshore wind is poised for major expansion in the North Sea and beyond. As part of the UK and EU's drive towards increased energy security and a low-carbon energy mix, the number of new wind turbines entering operation and supplying electricity to the grid is set to explode; and with this growth comes the ever-growing need for efficient servicing. Like all modes of energy generation, wind turbines require thorough inspections and continuous maintenance to ensure uninterrupted, optimal, and safe operations.

The transfer of engineers and equipment between shore and site is no easy feat – it needs an expert crew of experienced maritime professionals and vessels that are durable and comfortable enough to safely transit in all weather conditions, and there are number of diligent operators working throughout the year to ensure wind farms have the supply of engineers and equipment necessary to maximise yield from the farm.

But herein lies the problem: crew transfer vessels (CTVs) – designed primarily for quick transportation of personnel and light equipment – and service operation vessels (SOVs) – larger vessels that providing a base of operations designed for long-term – burn a significant amount of diesel. CTVs, for example, use around on average 1500+ l/d of fuel in operation. With around 400 vessels currently servicing the UK and Europe, this is a staggering amount of carbon emissions for a service operating at the forefront of renewable energy.

Figure 1. Crew transfer vessel (CTV) carrying crew and equipment to an offshore wind farm.

Figure 2. CTV servicing the offshore wind sector in the North Sea.

In a sector which generates gigawatts of energy from the forces of nature every year, surely there must be a better option than burning fossil fuels?

What can be done electrically, should be done electrically

The answer, quite clearly, is to electrify the entire system.

Electric crew transfer vessels, or E-CTVs, offer the same safety standards of any diesel-powered boat and can carry an equal load, yet they:

- Benefit from much higher reliability with lower maintenance costs.
- Are more comfortable for crew (without noise and vibrations from a turning engine).
- Benefit from significant noise reduction for people and wildlife above the water and marine life beneath.
- Most importantly, generate zero operational carbon emissions.

Battery density has advanced so rapidly in recent years that the industry is now at a point where it is not only feasible, but makes more economic and environmental sense to use batteries over internal combustion. A huge swathe of wind farm and service operators have 2030 decarbonisation targets, and with the availability of unlimited, cheap energy at source, electrification of CTVs and SOVs is a clear, yet wholly achievable ambition. So where should the industry begin on its journey to electrification?

Careful forward-planning is essential to maximise the positive economic and environmental impacts of transitioning towards decarbonised inspection and maintenance services. For example, if every wind farm operator made the switch to electric, what would happen to CTVs currently in operation? They could easily be exported other countries but, by doing so, the carbon emissions would simply be displaced elsewhere.

The alternative solution is to instead adapt existing diesel-powered CTVs to run on electric, which comes with a number of benefits over building new. Not only does electrically retrofitting vessels reduce the demand for fossil fuels and the significant emissions linked to decommissioning and building vessels, but it also greatly extends the operational lifecycle and keeps them in the value chain for far longer. This circular economy thinking ensures that the drive for sustainability does not counterintuitively contribute to further harmful waste and emissions.

The future of E-CTVs: Building an entire electric ecosystem

There is, of course, the sustainability question around the environmental impact of batteries. Crucially, what happens to the used batteries once they no longer have the capacity to function fully?

Modern batteries are not only significantly cheaper than they were a decade ago, but they degrade remarkably slowly – they only lose about 20% working capacity over a 10-year lifecycle. Even a battery at 80% working capacity still has its uses, but at the point when it does need replacing, the next generation of batteries will have much higher working capacities as energy storage technology evolves. When batteries are eventually swapped out, they can be utilised in a number of ways back on shore – the batteries of today will be the quayside batteries of tomorrow, offering a second life for the technology and greatly improving the circular economy of the sector.

Much like conversations around electric vehicles (EVs) on land, there is a certain 'range anxiety' attributed to the use of electric-powered vessels. However, the discourse should be shifted away from one of anxiety, and instead to one of proper planning and development of charging infrastructure to ensure efficient, reliable, long-range use of E-CTVs and E-SOVs. Efforts to scale up electric vessels would, after all, be futile without a robust charging infrastructure to support it.

Whether newbuild or retrofit, a new charging system must be developed in tandem with battery-powered propulsion. While onshore charging solutions can provide a convenient and reliable means for electric vessels to replenish their energy reserves at the quayside, it is in offshore charging infrastructure where the sector can truly move the needle. The integration of offshore charging, which allows E-CTVs to plug directly into wind turbines through both fixed and floating solutions, allows vessels to harness the abundantly available renewable energy directly from source and with high efficiency without transmission costs and losses. This greatly extends service vessels' time on the water and opens up wider areas of the sea that can be serviced by zero-emission vessels.

The ideal long-term future of charging infrastructure is one where all wind farms adapt to serve as offshore charging/fuelling stations for all maritime, not just those servicing the wind sector itself.

The elephant in the room: What about alternative fuels?

Alternative, lower carbon fuels like green hydrogen, ethanol, hydrotreated vegetable oil (HVO), and biofuels are, quite rightly so, gaining popularity and increasingly entering the discussion on decarbonised maritime. While these fuels certainly have their place in a net-zero future, their use-case for offshore wind services are actually rather limited.

Take hydrogen as an example – from a pure energy efficiency perspective, a very large proportion of raw energy is lost in the hydrogen making process. Combined, the energy cost for desalination, purification, and electrolysis comes up to around 50% of the total energy put in, even before the cost of compression, storage, transport, and ultimate conversion back to electricity.

With as little as 30% of the original energy left over at the end of the process, the question has to be: why choose green hydrogen when there is an unlimited, near 100% efficient source of energy at one's fingertips?

Hydrogen has been lauded the next step to decarbonised maritime but, in reality, it might not be feasible with the costs and timelines required to meet a quickly expanding offshore wind services sector. There is no doubt that green hydrogen should and will replace brown, blue, and grey hydrogens in energy-intensive sectors such steel and cement, but burning hydrogen to fuel CTVs does not make sense from a cost and efficiency perspective. Instead, the industry should start with electricity and end with electricity.

Other more circular fuels like HVOs have terrific potential to be used in a hybrid capacity, much like plug-in hybrid cars, but there just is not enough fuel available at the scale required to decarbonise the entire system.

In a real-world scenario, a hybrid vessel could sail out from shore with full battery to a site up to 30 – 40 miles offshore, using almost entirely battery power but supported with an additional small amount of diesel for range extension. While servicing a site, hybrid vessels can charge up and use 100% electricity for operations, and then use a small amount of diesel on the way back to shore. This form of operation can reduce diesel consumption by 90+%, which could be replaced with HVO, methanol, or other alternative fuels. This type of system is fuel agnostic, and as long as it leads to an impactful reduction in carbon emissions, it is a much more economical and sustainable alternative to how the system currently operates.

E-CTVs in practice

Tidal Transit is spearheading a world-first design and engineering project to actually retrofit a diesel-powered CTV, *Ginny Louise*, with over 3 MWh of battery capacity,

Figure 3. Render of *e-Ginny,* the world's first diesel-to-electric retrofit CTV.

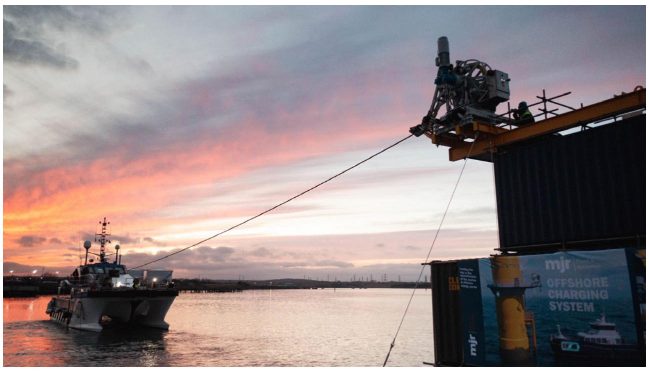

Figure 4. E-CTV utilising an offshore charging system.

electric motors, and propulsion pods. The resulting vessel, *e-Ginny*, will not only be 100% zero emissions in operation, but also offers increased manoeuvrability, improved safety, and be near-silent for passengers and passers-by.

The initiative benefits from £6.3 million of funding from the Zero Emissions Vessel and Infrastructure (ZEVI) competition, which was set up as part of Innovate UK and the Department of Transport's strategic plan to develop, deploy, and operate clean maritime solutions. Just 10 flagship UK projects were chosen to split more than £80 million in funding, with the aim of unlocking an industry-led transition to net zero.

As existing shoreside charging capabilities are severely limited, the project will also expand vessel charging infrastructure by installing both an onshore charging station (for overnight charging) and an offshore wind turbine based-charger. These solutions will enable direct E-CTV charging on location, greatly increasing the time and range that electric vessels can stay in operation without returning to port.

A prime example of the type of cross collaboration required to truly make waves in marine electrification, the multi-stakeholder project is being undertaken with partners Goodchild Marine Services, Artemis Technologies, and MJR Power & Automation, with key equipment suppliers such as Volvo Penta, Danfoss, and Corvus Energy.

As it currently stands, E-CTVs like *e-Ginny* have the capability to facilitate inspection and maintenance of wind farms up to 10 – 15 miles offshore, dependent on hull type, with e-foilers able to reach a distance of up to 25 miles. And that is just the beginning – with enabling technology such as offshore charging and the continued evolution of battery and propulsion systems, such vessels could be operating and servicing wind farms with zero-emissions over 100 miles from shore within 5 – 10 years.

The tide is turning towards electrification

As the offshore wind sector continues to expand and the greater need for inspection and maintenance is realised, closer attention must be paid to offering low carbon alternatives to impactfully drive down the carbon footprint of the industry. Otherwise, the industry risks undoing part of the terrific progress that wind energy is making in the global shift to a net-zero emissions energy system.

It is for this reason that the CTV and SOV industry need a serious rethink. Hydrogen and other green fuels certainly have their place in a low-carbon economy, but efficient electrification which harnesses the incredible power of modern batteries and cutting edge offshore and shoreside charging solutions is truly the future of a decarbonised offshore wind industry.