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## Economic Potential of Applying Circular Economy to AWE

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AWE companies has made tremendous technical progress in recent years. The next challenges will be the scale-up and the commercial expansion. Assuming the industry succeed in the future and become an important asset to the global energy transition, the Life Cycle Assessment of its components needs to be kept on sight. This is an obvious lesson learned from the 15.000 wind turbine blade material reaching the end of life in 2022. In a nutshell, circular economy concepts are Prevention, Reusing, Repurposing, Recycling, Recovering and Disposal. The higher in the “circular ladder”, the more desirable. In general, Prevention is achieved today in AWE technology by using relatively compact equipment. The state-of-the art technologies of the AWE companies rely on the flying kites, tethers and the control systems. In all this equipment, it will be hard to reuse existing materials upstream or downstream in the supply chain. Recycling approach needs to be kept in mind from early design phases. For the ground stations, specifically the generators, the repurposing approach needs to be analysed. Specifically, the possibility of using second-hand generators from other industries. The most obvious places to source old generators would be the old wind farms,

currently under decommission after reaching their lifespan. The possibility of reusing their nacelles (generators), needs to be explored, with the prospect to provide transmissions to the different land based AWE systems. Turbines operating from the year 2000 are approximately 200kW-800kW, very close to current AWE’s technical power. Each AWE company would need to analyse if the specifications of power and its mechanical and electrical properties would fit their technology. As a reference, second hand turbines available in the market are E30, V27, V39, V47, N29, N50 and B44. Original suppliers of these second-hand generators are the Utility companies, the exact same clients that AWE companies need to contact in their sale processes. They are paying large sums to recycle and dispose their complete wind turbines, so both parties would gain dramatically from this exchange. In some cases, there could also be commercial opportunities to install temporary AWE systems, during the replacement of old turbines for new ones (Repowering). It is paramount that during early stages, AWE companies adopt circular economy concepts in order to bring benefits to all stakeholders in the industry and to reduce the environmental impact of power generation.