
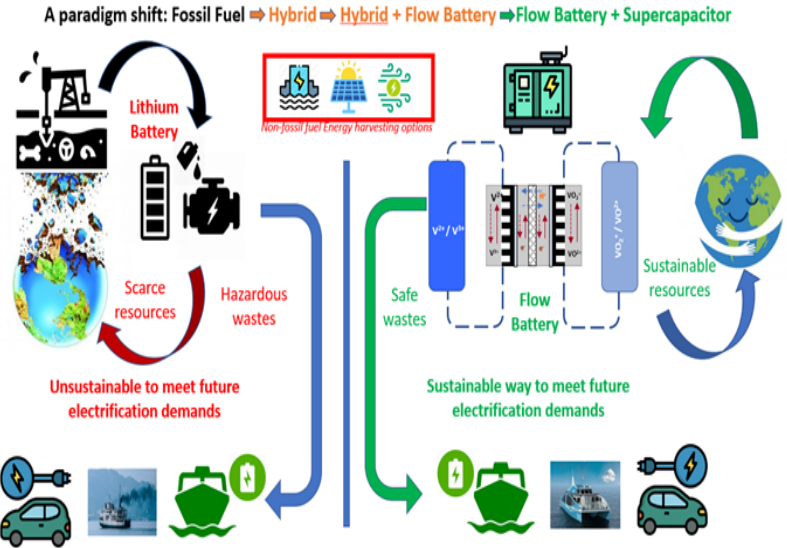
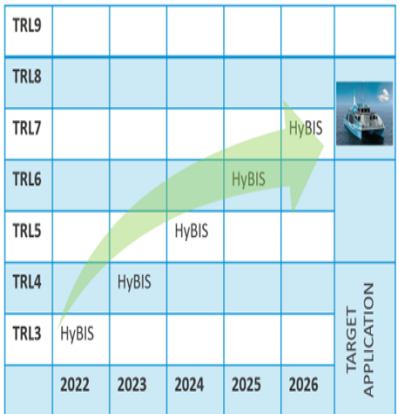



Project Title	HYBESS – INTEGRATED HYBRID-ENERGY STORAGE SYSTEMS FOR WATERBORNE APPLICATIONS																																																							
	Country	Contract value (€)	% carried out by Epsilon	No of staff provided	Client	Origin of funding	Date (start/end)	Consortium Members																																																
	Malta	9,646,000	10%	6	European Commission	HORIZON-CL5-2022-D5-01-02	01/01/2023 31/12/2026	NTUA (Coordinator), TWI, SEA GREEN ENGINEERING, EPSILON International Ltd, University of Leicester, ABERTAX Quality Ltd, ELKON, CRE, SKELETON Technologies, PINFLOW Energy Storage, Istanbul Sehir Halllari, MARIN																																																
Description of the project						Services provided																																																		
<p>HyBESS proposed to revolutionise maritime energy systems by integrating and demonstrating two emerging electrical storage technologies: Flow Battery Energy Storage (FBES) and Super Capacitor Energy Storage (SCES). The project would focus on waterborne applications, adapting both technologies for maritime environments, and validating their performance on board demonstrator vessels. In parallel, a comprehensive simulation and modelling platform would be developed to optimise energy storage configurations and evaluate safety, cost, and regulatory implications. HyBESS also targets reduced carbon emissions and increased electrification of maritime transport through hybrid configurations using ICE generators and renewable energy sources.</p>  <p>A paradigm shift: Fossil Fuel ⇒ Hybrid ⇒ Hybrid + Flow Battery ⇒ Flow Battery + Supercapacitor</p> <p>Unustainable to meet future electrification demands: Scarce resources, Hazardous wastes</p> <p>Sustainable way to meet future electrification demands: Safe wastes, Sustainable resources</p>  <table border="1" data-bbox="62 1013 459 1428"> <thead> <tr> <th>TRL</th> <th>2022</th> <th>2023</th> <th>2024</th> <th>2025</th> <th>2026</th> </tr> </thead> <tbody> <tr> <td>TRL9</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>TRL8</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>TRL7</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>TRL6</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>TRL5</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>TRL4</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>TRL3</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>TRL9: System Test, Launch & Operations</p> <p>TRL8: System/Subsystem Development</p> <p>TRL7: Technology Demonstration</p> <p>TRL6: Technology Development</p> <p>TRL5: Research to Prove Feasibility</p> <p>TRL4: Basic Technology Research</p> <p>TRL3: Basic Technology Research</p> <p>TRL2: Basic Technology Research</p> <p>TRL1: Basic Technology Research</p> <p>HyBIS = (Supercapacitor + Flow battery + hybrid/conventional energy)</p>						TRL	2022	2023	2024	2025	2026	TRL9						TRL8						TRL7						TRL6						TRL5						TRL4						TRL3						<p>Epsilon would:</p> <ul style="list-style-type: none"> • Lead activities under Work Package 6 (WP6) • Conduct risk assessment and safety evaluations for integrated energy storage systems • Perform life-cycle cost analysis (LCCA) of FBES and SCES technologies • Contribute to the development of regulatory pathways for hybrid energy storage integration in maritime transport • Deliver environmental impact assessments (EIA) for demonstrator deployments • Provide technical support for the development and validation of the HyBESS simulation platform • Support dissemination activities and stakeholder engagement • Contribute to the market-readiness strategy and exploitation planning  <p>Visual Energy Demand Calculation: Size + Weight + Safety</p> <p>Supercapacitor Requirements: Energy + Size + Charge Cycle</p> <p>Flow battery requirements: Energy + Size + Electrolyte Safety</p> <p>Hybrid Battery Integrated System (HyBESS) technology parameters</p> <p>Safety and risks mitigation strategies</p>		
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