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Demonstration of ship-based carbon capture on LNG fuelled ships (EverLoNG)

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Abstract

The maritime sector aims to reduce CO_2 emissions from international shipping by at least 50% by 2050. Ship-Based Carbon Capture (SBCC) is proposed as a low-cost alternative to decarbonize the maritime sector, as compared to zero-emission fuels (e.g. ammonia, hydrogen). The objective of this project called 'EverLoNG', see Figure 1, is to accelerate the implementation of the SBCC technology by: (i) demonstrating SBCC on-board of LNG-fuelled ships; (ii) optimising SBCC integration to the existing ship infrastructure; (iii) facilitating the development of SBCC-based full CCUS chains; (iv) facilitating the regulatory framework for the technology.

Figure 1. Graphical summary of the project EverLoNG and its partners.

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Objectives of EverLoNG

EverLoNG will validate and demonstrate the SBCC technology on-board of two LNG-fuelled ships, owned and/or operated by project partners TotalEnergies and Heerema. The demonstration will bring SBCC from TRL4 to TRL7. To accelerate the SBCC technology implementation, EverLoNG will close knowledge gaps and address challenges in both technical and commercial levels. The project will run for 3 years, during which we will:

- Develop strategies for reducing CO_2 emissions of ships by at least 70%, taking the same ship running on LNG but not equipped with SBCC as the reference case; and demonstrate the emission reduction potential of SBCC according to the EEDI and EEXI guidelines;
- Develop solutions to improve the cost effectiveness of SBCC, achieving CO_2 capture and on-board storage costs below 100 €/ton (1st of a kind, to be achieved by 2025) and 50 €/ton (nth of a kind); as well as evaluate the costs of off-loading, transport and storage (or utilization) of CO_2 in several CCUS chains;
- Evaluate the impact of SBCC on the ships' infrastructure, stability and safety, to guarantee the technical feasibility of the proposed technology; identify the major safety hazards associated with SBCC technology and determine safeguards to mitigate those risks, thus providing the basis for (near) future class approval of the SBCC technology;
- Develop off-loading strategies that clarify the post-treatment required on-board, as well as the infrastructure necessary on the port side; establish a CO_2 Shipping Interoperability Industry Group (CSIIG) and propose a Roadmap towards a European off-loading network.

Project structure

The project is divided in five technical work packages and one management work package. The WP structure is organized to facilitate the workflow and exchange of data, as indicated in Figure 2. The activities within EverLoNG go far beyond demonstrating SBCC (WP1). The data gathered during demonstration will inform the design of full CCUS chain integration (WP2), the assessment of the impact of the SBCC technology on ship infrastructure (WP3), and the life cycle and techno-economic assessment (WP4). The research performed in WPs 3 and 4 will close the current knowledge gaps and generate the necessary information to WP5, thus enabling the development of a regulatory framework for SBCC, which is key for timely deployment of the technology.

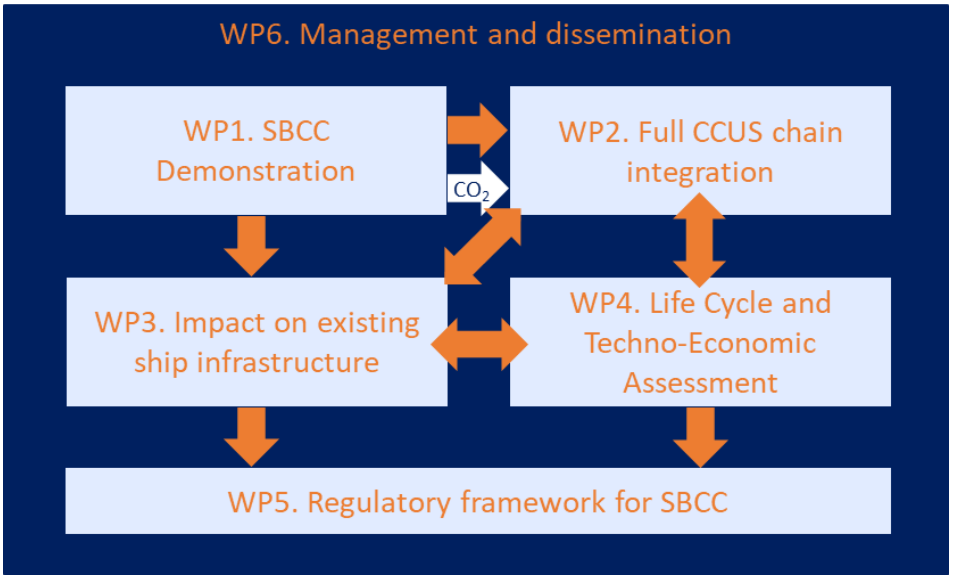

Figure 2. WP structure in EverLoNG. Orange arrows indicate data transfer between WPs. The white arrow indicates the transfer of CO2 from WP1 to WP2.

SBCC technology

Figure 3 schematically shows the potential integration of the SBCC system on-board of the LNG ship, as will be researched and optimized in EverLoNG. The final paper will discuss the objectives of the project in more detail and will elaborate on the status of the project at that moment.

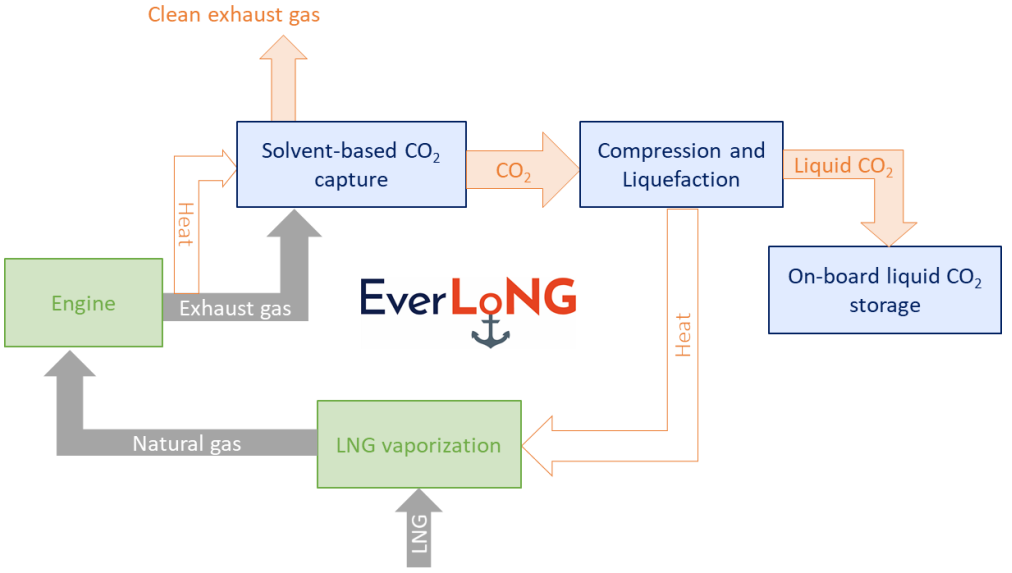

Figure 3. Schematic representation of SBCC technology integration on LNG fuelled ships. Green boxes: existing systems that will be modified. Blue boxes: systems added to the ship infrastructure.

Keywords: Carbon capture; maritime; ships; CO_2 infrastructure; CO_2 off-loading