Brief description of the project

- **Company name:** Cantieri Navali dello Stretto
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- **Title:**
  Study of the process of technological transformation of the propulsion system of a vessel aimed at reducing greenhouse gas emissions

- **Description of the scientific and educational objective:**
  In recent years, the C&T group has focused its attention on the decarbonisation of its fleet. The aim is both to satisfy the requirements of regulations about the greenhouse gas emissions (e.i., CO2, SOx, Nox) and to reduce the impact within the urban area of the Strait of Messina.
  This can be achieved through the energy and technological efficiency (e.i., reduction of electrical loads on board or increase in navigation performance), the installation of monitoring systems, the introduction of alternative propulsion technologies or the use of green fuels.
  For the company, these activities mean the reduction of the consumption of fuels and, consequently, the economic savings to be invested in further decarbonisation interventions. For the urban area, these mean the increase of air quality and, therefore, a social well-being.
  These industrial decisions are in accordance to the PNRR which aims to make "the Italian system more sustainable in the long term, through the progressive decarbonisation of all sectors". This objective implies the development of a more sustainable mobility and the start of a gradual decarbonisation of the industry, also including the adoption of hydrogen-based solutions, as defined by the European Strategy (European Commission, A hydrogen strategy for a climate-neutral Europe, July 2020), and also considering the growing of electrochemical storage. They are also in accordance to the Strategic Document for the programming of the Sicilian Region ERDF 2021-2027. In particular, in the context of the sustainable local transport, the PNRR investments include the renewal of the Mediterranean naval fleet with clean fuel vessels, with particular attention to the fleets operating in the Strait of Messina.
  The topics related to decarbonisation processes, as widely verified during the development of the research projects in which the company has been involved in recent years, required the use of highly qualified people and consultants, with qualifications connected to academic courses, or in any case connected to research and innovation activities, sometimes even with certifications the possession of which requires significant qualifications and skills. For this reason and in accordance to PNRR in terms of activation of doctoral courses with subjects outside the university, the company has chosen to invest in a resource that can receive high quality training, apply directly in the field its skills thanks to the supervision and guidance of the technicians of the Technical Office and to carry out periods abroad that can further increase the technical skills thanks to the contact with international best practices.
  The theme of the proposed doctoral program is ambitious because it is about the propulsion system of a naval vessel, which represents the key element of the entire decarbonization process. Acting on the propulsion system, in fact, not only reduces the consumption but

involves also a radical transformation of the ship-plant system with a significant reduction in the ecological footprint. This highly innovative transformation involves not only the field of the energy efficiency but also several integrated areas, i.e., from manufacturing technologies to the control of corrosive processes, from legislation on the application of innovative technologies up to risk assessment and maintenance, from design to works.
Intervening on the propulsion system of a vessel means to evaluate the feasibility of technologies that in the naval field are pioneering compared to other areas in which they are successfully applied: from the implementation of LNG propulsion systems to the possibility of using bio-LNG, from the mechanical diesel/electric conversion thanks to the installation of electric storage to the possibility of using fuel cells powered by hydrogen. Thanks to its experience, which in the last decade has led from the study of LNG systems to the construction of the first diesel/LNG dual-fuel ship, the company will be able to provide the doctoral student with a series of tools suitable for the application of new technological solutions based on the type of ship studied (single-deck or double-deck, diesel or diesel/electric propulsion, etc.). So the research activity will develop on the basis of the identification and study of the most critical aspects related to the solutions identified.

- **Company Supervisor:** eng. Maurizio Vecchio

- **Methods of training and research activities:**
The company, in addition to the academic course that PhD students will follow in the three-year period, will manage a highly applicative course divided into 3 modules that will be distributed over the three years taking into account the time that the student will spend in the company, including the training period abroad:
  - 1st year
    - Regulatory/economic module: sector regulations, regulations on emissions, controls and verifications, obligations, MRV and SEAMP, tasks of regulatory bodies, project financing and project management.
  - 2nd year
    - Monitoring and energy efficiency.
  - 3th year
  - Propulsion systems: mechanical and energy aspects, fuels, focus on the construction of the Elio ship.

  The modules will be held by the technical staff and by some consultants from C&T and Cantieri Navali dello Stretto.

- **Effects and expected results with particular emphasis on promoting the economic development and the production system:**
The work has a significant impact not only for the company due to the increasing of the performance of old vessels characterized by obsolescence, but also for its impact on other companies. The possibility of radically transforming the propulsion system of a ship by introducing innovative technologies involves an increase in work that includes the supply of the equipment necessary for the conversion (e.g. engines, storage, hardware, etc.), the development of management software, the execution of all the works in the basin (from the carpentry to the installations of the machines). This increase involves both regular suppliers and new suppliers identified on the basis of the results of the research activities. In order to quantify the impact of the activities, performance and economic indicators will be identified (e.i., number of employees involved in the development of the new propulsion system both internal and external to the company organization, budget for ordinary and extraordinary maintenance).

- **Period in the company**

  The proposing body (Cantieri Navali dello Stretto srl) will host the PhD student beneficiary of the scholarship financed on the resources of the Ministerial Decree 352/2022 for no. __**18**___ months during the PhD program.

- **Period abroad:**

  Period abroad for no. __**6**__months at the following institution:
  Center of Maritime Technologies gGmbH (CMT)

We also declare that this program complies with the principle "not to cause significant damage" (DHSH) pursuant to art. 17 of regulation (EU) 2020/852 in coherence with the technical guidelines prepared by the European Commission (Communication of the European Commission 2021 / C58 / 01) and guarantees compliance with the horizontal principles of the PNRR (contribution to the climate and digital target so-called tagging, the principle of gender equality and the obligation to protect and enhance young people).