

# Mapping of Zero Emission Pilots and Demonstration Projects

Fourth Edition | May 2023

## Methodology

### Definition of pilots and demonstration projects

The mapping covers projects which focus on zero-emission pathways for the maritime industry and includes ship technology, fuel production, as well as bunkering and infrastructure projects. Please refer to the Getting to Zero Coalition's [technical guidance](#)<sup>1</sup> for a fuller definition of what constitutes zero emission.

The term pilots and demonstration projects exclude projects or services which are now readily available to the mass market. This means, for example, that bio-diesel projects are considered out of scope as there is already an existing market for them, whereas new biofuel production processes based on waste products will be considered in scope.

### Project focus

The following section outlines the three focus areas projects in this study fall under. The project focus is categorised based on whether the project addresses ship technology, fuel production or bunkering and infrastructure. Some projects may have multiple focus areas.

#### Ship technology projects

Ship technology projects involving fuels that can be produced from “non-green” sources such as grey ammonia and methanol are considered in scope irrespective of the fuel used in the projects, as they have the potential to transition to green fuels in future.

Onboard CCS projects are included in the mapping as they, in combination with other low carbon fuels, could achieve zero-emission vessels.

Smaller vessels (under 5000 dwt) will also be included due to their potential to trial and realise zero-emission technologies aboard larger vessels.

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<sup>1</sup> [Getting to Zero Coalition, Definition of zero carbon energy sources](#)

For projects focusing on wind propulsion, only large ship projects (over 5000 dwt) which derive over 50 per cent of their propulsion from wind will be included.

Projects dealing purely with fuel transportation are considered out of scope. This includes pressurised/cryogenic technology with a focus solely on transportation.

Projects which are purely focused on energy efficiency, whilst extremely important in reducing GHG emissions from shipping, are not considered within scope for the mapping.

## Fuel production projects

Fuel production projects are within scope for the mapping where they specifically anticipate producing marine fuels. Where a partner on the project is a member of the Getting to Zero Coalition, the project will be considered to anticipate the production of marine fuels.

Fuel production projects are still considered a demonstration project if it represents one of the first few examples of a new technology being introduced to a given market.<sup>2</sup> Fuel production projects which use renewable energy, biomass or fossil fuel feedstocks combined with CCS to produce marine fuels, are considered to be in scope. For synthetic carbon-based fuels, these will be considered within scope if the feedstock is based on biomass, other potentially net-zero feedstocks, or direct air capture.

For biofuel projects, only biofuel production based on second- and third-generation technology (ligno-cellulosic and algae/marine feedstocks) are considered in scope for the mapping, due to the maturity and commercial viability of other biofuels.

Onshore power projects will be considered within scope in so far as they focus on recharging batteries for use aboard ships. Projects supplying power for use only during berthing and not ultimately for propulsion are considered out of scope.

## Bunkering and infrastructure projects

Bunkering and infrastructure projects include the supplying of fuel for use by ships including the logistics of storing, loading, and distributing the zero-emission fuel.

## Project categorisation

With the three project focuses in mind, the following section outlines the different project categories the study accounts for. Where a project has a significant connection to two categories (i.e., Asia and Europe for Geographical location), both will be counted for the purposes of the data. Examples of categorisations are given in bold.

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**2 International Energy Association (IEA)'s definition of what constitutes a demonstration project in the energy sector**

## **Project type**

- » The project type refers to the current phase or level of development of a given project. This is categorised based on whether the project is a concept study (planned on paper), a laboratory test (test in a controlled environment) or a demonstration in normal operations.

## **Fuel focus**

- » The main categories of fuels covered by the mapping are ammonia, battery power, biofuels, methanol, hydrogen, wind propulsion, liquefied biogas/synthetic methane, and other.
- » The other category includes projects with no specific fuel focus or projects involving for example, CCS or CCU.

## **Ship size (for ship technology projects)**

- » For projects specifically related to ship technologies, the size of the vessel will be included in the mapping. Large vessels are counted as being over 5000 DWT as per IMO Regulations, whilst small vessels are counted as being under 5000 DWT.
- » Where the size of a ship was not determinable through reference to publicly available information, the size of the ship was estimated.

## **Lead partner and other companies/stakeholders involved**

- » The lead partner is the partner who is overall responsible for the management and delivery of the project.
- » Other companies/stakeholders involved are those involved in, or partly involved in, the delivery of the project, e.g., a partner focusing on the engine testing of a ship technology, or a classification society approving the concept of a ship design.

## **Geographical location of project**

- » The location of the project is determined by looking at where the project is mostly based (continent and country). For projects with no specific geographical focus, the location of the lead partner is used.
- » Where a ship technology project has a significant connection to a given route, the geographical location of the route will be counted as the geographical location of the project. The nationality of the lead partner will be used where the route doesn't have a significant connection to the project.

## **International industry collaboration**

- » The collaboration between geographies is determined by the geographical location of each of the partners involved in the project. Unless otherwise stated, this is determined by the partners' headquarters.

## Timeline of project

- » The timeline of the project indicates the start date and completion date of the given project. Where concrete timelines are not available, a best estimate is made.

## Public funding

- » Whether the project is considered publicly funded depends on the direct receipt of public funds to the project itself.
- » Where a partner is a public entity, this will not be considered as funding for the project.
- » If publicly available, this category also includes the source and amount of funding.

## Additional information

- » This will provide links to additional publicly available information on the given project.

## Definitions

**Green Hydrogen:** Hydrogen produced through the process of splitting water into hydrogen and oxygen through electrolysis using renewable electricity.

**Blue Hydrogen:** Hydrogen produced from fossil sources, where the carbon emissions are captured and stored.

**Green Ammonia:** Green ammonia is produced through combining green hydrogen with nitrogen separated from the air.

**Renewable Methanol:** Renewable methanol can be produced by combining green hydrogen with CO<sub>2</sub>. It can also be made from sustainable biomass, where it is commonly referred to as biomethanol.

**Biofuels:** Refers to liquid fuels, which can be dropped into existing diesel engines (biodiesel). This excludes other types of fuels which can be produced from biomass (i.e. biogas, bioethanol, biomethanol).

**Liquefied biogas/Synthetic methane:** This category includes natural gas produced from biomass and synthetic methane produced using renewable electricity plus carbon source.

**Lignin Ethanol Oil:** A blend of ethanol and lignin, lignin is a structural biopolymer which helps to stabilise hydrogen for use as a fuel.

**Power-to-X:** Power-to-X refers to the use of electricity as primary energy input to create energy carriers in other forms (gases, liquids, heat, cold, chemicals, etc.). Here the term refers to maritime fuels using hydrogen produced by electrolysis.

## Links

Please consult the Getting to Zero Coalition's **technical guidance** for further information on the types of technologies covered under zero-emission pathways.

**Third edition of the Mapping of Zero Emission Pilots and Demonstration Projects**  
(March 2022)

**Second edition of the Mapping of Zero Emission Pilots and Demonstration Projects**  
(March 2021)

**First edition of the Mapping of Zero Emission Pilots and Demonstration Projects**  
(August 2020)