ENERGY TRANSITION PARTNERSHIP INNOVATION AND RESEARCH WORKSHOP

Workshop Report

Background

Following on from the Communication on Energy Transition in EU Fisheries and Aquaculture of 21 February 2023 and the launch event of the Energy Transition Partnership (ETP) in EU fisheries and aquaculture on 16 June 2023, the ETP hosted a stakeholder workshop on the topic of Innovation and Research. This workshop, focused on innovation and technology, was the next in a series of thematic workshops following the Finance one held on November 28, 2023. In this workshop, break-out groups further explored the topics introduced in the presentations, facilitating in-depth discussions around the theme on challenges and way forwards. The next workshop will address the topic of skills required for the energy transition, and is scheduled for 19 April 2024.

Workshop objective and deliverables

The workshop aimed to:

1. Map the current available innovation and technology opportunities for the energy transition, including gear, engine innovation and alternative fuels.
2. Explore and identify current innovation and technological gaps and possible solutions in areas of research towards the energy transition in fisheries and aquaculture sectors.
3. Explore and identify how we can collaborate and make use of synergies to advance innovation and research in the energy transition in the fisheries and aquaculture sectors.

Target audience and expected inputs

The workshop was open to all stakeholders that expressed their interest in the Energy Transition Partnership. Participating stakeholders came from across fisheries, aquaculture, and related sectors, including fishers and aquaculture producers, financial sector, fishing port authorities, insurers, NGOs, Advisory Councils, researchers and academia, shipbuilders, Member States and regional authorities dealing with relevant public (EU and National) funding tools plus EMFAF correspondents.

Workshop execution

The workshop was split in two parts: Part 1 focused on the introduction to the challenge of research and innovation, while Part 2 instigated breakout discussions with participants to elicit feedback that would ultimately inform the roadmap.

The presentations delivered during Part 1 of the workshop are summarised below.

Part 1: Welcome and introduction to the day and presentations of the research and innovation examples

Delilah Al Khudhairy (DG MARE) – Introduction to the challenge of financing

Ms Al Khudhairy opened the workshop with a warm welcome, expressing delight at the significant turnout, both physically and online. Acknowledging the challenges faced by the sector, Ms Khudhairy highlighted the importance of collaboration and knowledge sharing.

Formed over a year ago, the Energy Transition Partnership aims to address vulnerabilities in the sector exposed by external factors. Ms Al Khudhairy emphasised the need for a transition to reduce dependence on fossil fuels and minimise the carbon footprint. She also announced that a "call for representatives" would soon be launched with the aim to establish a support group to help frame the work needed to support the sector and to help define the roadmap, which will be important for achieving the energy transition.

Recent initiatives, such as a call for proposals for a demonstrator of a fishing vessel (deadline of the call is 11th of June) and an updated online version of the compendium of good practices were shared. Additionally, Ms Al Khudhairy highlighted a recent in-depth study on relevant technologies and research viability commissioned by the Commission. Ecorys, the contractor in charge of the study, presented key results later in the workshop, and participants were encouraged to provide feedback.

Subsequently, Ms Khudhairy discussed challenges in the energy transition, particularly in innovation and research, emphasising insufficient knowledge transfer and slow progress in validating technologies. She unveiled the workshop as the first step in addressing these challenges, fostering discussions, and seeking solutions. The importance of wider application of ready technologies was stressed, setting the stage for collaborative efforts and the development of a roadmap.

Ms Al Khudhairy thanked the audience for their participation and reiterated that the workshop is a crucial milestone in advancing the energy transition in the fisheries and aquaculture sector.

Hugh Gardner & Roberto Pastres (ECORYS) - Techno-economic analysis for the energy transition of the fisheries and aquaculture sector

Mr Gardner introduced the techno-economic analysis of the energy transition in EU fisheries and aquaculture. As the leader of the study, Mr Gardner provided a brief overview of the objectives, underlining the need to establish baseline energy costs and carbon emissions, analyse low-carbon innovations, and identify barriers and synergies across the sectors.

For fisheries, Mr Gardner outlined the logical analysis process, starting with developing the baseline and identifying innovations. The analysis involved estimating readiness levels, capital and operational expenditures, and building cash flows for each innovation. A "sea ship model" was then used to create marginal abatement cost curves, offering a cost-efficiency ranking. Financial indicators, including payback period and net present value, were analysed, followed by an examination of non-financial dimensions and barriers within the broader enabling framework.

Mr Gardner presented a snapshot of the baseline, highlighting fuel price volatility and noting a decrease in average energy costs and carbon emissions per tonne of fish landed over time. The EU fishing fleet's

emissions account for about 3 to 4% of EU maritime emissions, with large-scale fisheries contributing the majority.

The analysis identified 45 innovations across various categories, such as engine and propulsion, vessel design, alternative fuels, assisted propulsion, fishing gear, and onboard processing. Mr Gardner briefly discussed financial indicators, noting that small-scale fisheries innovations are currently loss-making, with varying financial gaps for different solutions. Transition to biodiesel appears promising for large-scale and deep-water fishing.

Mr Gardner encouraged further exploration of the report for a more in-depth understanding, providing a link for reference.

Mr Pastres discussed the aquaculture sector's unique characteristics and the complexity of its supply chain, emphasising the potential impact on the final product based on processes like feed production or shellfish farming. To assess greenhouse gas emissions at the system level, a life cycle assessment (LCA) tool was employed. Mr Pastres outlined the methodology, starting from scratch with no previous inventory of emissions from aquaculture.

The study identified main aquaculture species in the EU and estimated the baseline emissions using LCA. The process involved careful analysis of peer-reviewed literature, creating a model portfolio to reproduce results, and addressing gaps identified in the literature review. The LCA tool also facilitated the assessment of environmental benefits from innovations.

Results of the inventory showed varying emissions across different types of aquaculture, with shellfish accounting for 12%, seabream and seabass 40%, and trout 26%. The study proceeded to test innovations on representative case studies, focusing on shellfish, hatchery, seabass, seabream, and rainbow trout. Mr Pastres presented an example on trout, demonstrating a significant reduction in emissions through the installation of photovoltaic panels and an oxygen generator.

In summary, the identified innovations primarily revolved around the switch to alternative fuels and electric boats. Mr Pastres remarked the potential for significant emission reduction, particularly in marine fish farming, through the adoption of renewable energy sources and electrified solutions. The aquaculture sector's emissions, while not as large as agriculture, can be substantially reduced through these innovations.

Martina Desole - European Network of Living Labs, ENoLL

Ms Desole introduced the concept of Living Labs and their role in solving complex issues through an open innovation ecosystem. Living Labs engage in real-life environments, using a systemic user co-creation approach involving stakeholders from academia, government, industry, and citizens.

Living Labs operate based on six main blocks, including orchestration, multi-stakeholder participation, interdisciplinary approaches, active user involvement, real-life settings, and a multi-method approach. Ms Desole stressed the importance of living labs as modern research tools, serving as research infrastructure and supporting a vision of data harmonisation.

Ms Desole provided a visual representation of living labs, illustrating their engagement with various stakeholders – similar to hospitals or cities – tailored to the fishery and aquaculture sector. Living Labs utilise design thinking and an integrative process involving exploration, experimentation, and evaluation to address problems and co-create solutions.

Living Labs also function as trust brokers, building relationships with the Quadruple Helix, ensuring a trustworthy approach to data usage and feedback. They serve as regional innovation hubs, involving regional and local authorities, and contribute to bridging the research-market gap.

The speech highlighted the benefits of Living Labs, such as faster innovation cycles, bridging the gap between research and adoption, and involving users as actors rather than factors. Challenges include theoretical and methodological issues, governance and process-related issues, and ethical considerations related to data usage.

Ms Desole showcased the EU-supported Living Lab initiatives and shared an example of a member's activities in Ostend, Belgium, where Living Lab methodologies are applied to fisheries, aquaculture, processing, retailing, sand extraction, dredging, wind energy and blue biotech. Certification ensures the proper use of Living Lab methodologies.

The presentation concluded by inviting participation in upcoming events and emphasising the global presence of Living Labs to promote the approach.

Jaap Gebraad - Research and Innovation in Waterborne transport, The Waterborne Technology Platform V.Z.W

Mr Gebraad discussed the activities of a European technology platform focused on waterborne transport. The platform collaborates with the European Commission to define research and development priorities, particularly in achieving zero-emission solutions for waterborne transport by 2030. The platform, with 120 members from 21 Member States, testifies to the importance of the waterborne sector in the broader European context.

Mr Gebraad explained that the partnership was established in 2021 for zero-emission waterborne transport, highlighting its uniqueness and its alignment with the European Green Deal and the International Maritime Organisation targets. The partnership aims to develop and demonstrate zero-emission solutions for various ship types and services by 2030, with an allocated budget of up to €530 million in Horizon Europe.

The presentation outlined six main ship types for classification and discussed the focus areas of the partnership, including sustainable alternative fuels, electrification, energy efficiency, and digitalisation. Mr Gebraad pointed out the importance of addressing emissions from the current fleet while exploring economically viable and environmentally sustainable solutions for new vessels.

Several examples of ongoing projects and demonstrations were provided, showcasing the use of tri-fuel (ammonia-based) engine in an existing vessel, retrofitting of a bulk carrier with innovative technologies in terms of energy efficiency, exploring hydrogen as a primary energy source for electric power generation, and wind-assisted propulsion. Mr Gebraad stressed the need for continued research and development, business case preparation, and strategies to stimulate deployment, especially for SMEs involved in maritime transport.

Margherita Cappelletto (Ministry of University and Research, Italy) - Innovation in the Sustainable Blue Economy Partnership

Ms Cappelletto introduced the Sustainable Economy Partnership, a collaboration between Member States, associated countries, and the European Commission, with a budget of 450 million euros over seven years. The partnership focuses on research and innovation, aiming to structure the European Research Area. The strategic research and innovation agenda, currently under revision, outlines five priority areas: (i) planning and managing sea-uses at the regional level; (ii) development of offshore marine multi-use infrastructures; (iii) climate-neutral, environmentally sustainable, and resource-efficient blue food and feed; (iv) green transition of blue food production; (v) Digital Twins of the Ocean (DTOs) use cases.

Ms Cappelletto highlighted the ongoing joint calls for research and innovation, particularly the current call focusing on four topics, merging the management of resources and sustainability of production. Notably, the community has shown significant interest in the thematic area of climate-neutral, environmentally-sustainable, and resource-efficient blue food and feed.

The partnership takes into account regional and geographic specificities in project implementation to address local needs. The presentation included an overview of funded projects and their geographical distribution, and underlined the integration of regional strategies for a pan-European approach.

Priority Area 3, related to blue food and feed, was discussed highlighting projects aiming to reduce CO2 emissions in the food and feed sectors. The emphasis is on decarbonisation and carbon neutrality as underlying objectives in various projects.

Ms Cappelletto mentioned the structuring activities that the Sustainable Economy Partnership is carrying out, including collaboration with the zero-emission Waterborne Technology Platform and updates to priority areas, incorporating aspects like port resilience and tourism.

In the second cycle of the partnership, a key point is the introduction of a portfolio of projects, aiming to cluster projects with similar themes or regional focus. Ms Cappelletto encouraged collaboration between project coordinators to identify synergies, avoid overlaps, and propose policy briefs based on shared knowledge.

The presentation concluded with an overview of projects and links for further information. The audience was invited to explore the partnership's website and consider the opportunities available until the 10th of April for the second joint call, focusing on blue resources, fisheries, and aquaculture sustainability.

Gorka Gabiña - Examples of projects carried out by AZTI

Mr Gabiña introduced AZTI as a marine and food research institute with a team of over 300 professionals in three centres in the Basque Country, Spain. The institute focuses on diverse projects, combining on-board experience, laboratory analysis, and computational studies. The main research lines include fishing gear, fleet selectivity, digitalisation, artificial intelligence, decarbonisation, energy efficiency, marine litter, circular economy, and innovative processes on board.

Mr Gabiña emphasised the diversity of fishing vessels in terms of dimensions, areas, speeds, gears, and fuel consumption, stating that there is no one-size-fits-all solution for energy efficiency.

The presentation outlined strategies for decarbonisation and circular economy aspects in the fishing industry. Key outputs include the importance of monitoring fuel consumption and operational patterns, with a focus on diverse solutions for energy efficiency. Examples of projects, such as electrification in small-scale fishing fleets and retrofitting a school fishing vessel with an electric propulsion system, were discussed.

Mr Gabiña stressed the significance of real-life living labs, showcasing several examples, including retrofitting of a fishing vessel from diesel propulsion to hybrid/electric, smart grids in ports with renewable energy for charging, and the development of decision-making tools for efficient operation. Feedback from the fishing community was highlighted, underlining the need for stakeholder involvement. Mr Gabiña mentioned challenges in the sector's resistance to change and the importance of financial support from various backgrounds, including subsidiary companies, the fishing sector, public administrations, and funding opportunities.

Mr Gabiña concluded that the decarbonisation of the fishing fleet is crucial for a more profitable and less energy-dependent sector. He highlighted the need for monitoring energy consumption and operational profiles, pointing out that one-size-fits-all solutions do not exist in the real world.

Another conclusion highlighted the importance of motivating the sector, acknowledging the divergent objectives of skippers and shipowners. Mr Gabiña stressed the need for better communication, flexible and inclusive funds, and addressing barriers like fishing capacity limitations. Specifically, he mentioned the paradox of increased gross tonnage, which is not necessarily conducive to increased ability to fish, citing the need for more space for alternative fuel tanks and innovative vessel designs.

Part 2: Knowledge sharing and networking

Below is a list of probing questions posed to participants during two breakout sessions. Participants were asked to share their experiences and advice on the specific topics. Responses to these questions have been collated in the section "Workshop outputs".

Breakout session I: Problem definition, challenges, and research gaps:

1. **How do you judge the availability of technology/innovation for the energy transition in your sector? For fisheries, how do you assess the different technologies according to the type of fleet and the type of vessel? In aquaculture, for which activities do you see a need for more technology/innovation?**
2. **In which innovation area do you find is the lowest amount of relevant technology and innovation available taking place (e.g. alternative fuels, gears, engines, hull design, infrastructure)?**
3. **From your experience, what are the main challenges (e.g. availability, economical risk, uncertainty, infrastructure needed like ports, etc) you encounter in accessing and using new technology opportunities, according to your sector/industry (e.g. fisheries, aquaculture, shipping, gear manufacturer, ports)?**

Breakout session II: Technological and innovation solutions & possible actions:

1. **Regarding the current state of the transition in your sector, where do you believe is the most potential for innovation and research for accelerating the energy transition in the sector (e.g. alternative fuels, gears, engines, hull design, infrastructure)? What are the most feasible technologies to be implemented in your sector? Please take into account your business type (fisheries or aquaculture), the type of vessels used, etc**
2. **What are the most important actions to be taken in the short term by the different group of actors in the energy transition, to overcome the current challenges in the availability and accessibility of innovation and technology? And what are the actions on the medium to long term?**
3. **How can the sector use synergies from other sectors on innovation and technology and how can this help advance the energy transition in the EU fisheries and aquaculture sector?**

Workshop outputs

This section summarises the key points captured during the discussion.

Breakout session I: Problem definition, challenges, and research gaps

- **Technology uptake and application**.
    - Despite the general availability of technology, the main hurdle lies in the practical application and uptake within the fisheries and aquaculture sectors. The implementation proves to be challenging due to factors such as immaturity of solutions and financial constraints. Not only are they deemed too costly, but increased operating costs have also been observed, accompanied by declining profits.
    - There are a number of promising projects that face challenges when it comes to implementation. Specifically, there is a concern about not giving enough attention to the technical details and features that might impede progress. Additionally, the uncertainty and instability of the market make producers hesitant to initiate changes, especially in the context of the ongoing energy transition in both fisheries and aquaculture.
- **Need for efficient fisheries management**. A critical requirement for successful energy transition in fisheries is the need for efficient management. This involves not only reducing emissions but also determining how to increase profitability and commitment from the sector.
- **Role of fishers in implementation.** Fishers are identified as crucial stakeholders in technology implementation. However, it was noted that fishers are rarely the first movers and often follow larger sectors. It was suggested that for technology to be effectively implemented in the fishing industry, it needs to be industrialised. In turn, this requires the creation of specialised service sub-sectors that can effectively implement technology within the fishing industry.
- **Implementation of the energy transition in the aquaculture sector**:
    - Diversity in aquaculture systems. The considerable variety in aquaculture systems poses a significant challenge. Solutions developed for one system may not seamlessly translate to others, introducing complexities in implementation.
    - The design and planning of aquaculture facilities are not optimised for energy efficiency or sustainability. Energy considerations, such as the energy requirements of the facility or the efficiency of energy usage, are not being taken into account.
    - Fisheries displacement in policy decisions. When policies are formulated regarding aquaculture, the potential impact on existing fisheries is not adequately considered. Introducing aquaculture facilities can sometimes lead to the displacement of fishing activities. This aspect should not be overlooked by policymakers when making decisions about aquaculture development.
    - Neglect of travel time/costs and CO_2 emissions correlation. When assessing the sustainability of aquaculture operations, it is essential to consider the transport of goods and the associated costs and emissions. These factors should not be overlooked. Travel time and costs, as well as their correlation with CO_2 emissions, don't seem to be being factored into the decision-making process regarding aquaculture. This oversight could lead to inefficient transportation practices and increased environmental impact.
- **Focus on the entire value chain**. A holistic approach to research and innovation is deemed necessary, extending beyond production to encompass the entire value chain. A particular emphasis should be placed on the processing steps within the fisheries and aquaculture sectors. Up to this date, **the processing sector feels it has not been included** in the energy transition and decarbonisation discussion, even though technology implementation seems to be relatively straightforward (e.g., in the aquaculture processing facilities on land). From the perspective of

some participants, another example of a sector not included in the discussions of the energy transition is fish transport in inland aquaculture.

- **Lowest innovation areas and uptake**
    - **Innovation in digitalisation and monitoring tools for energy use**, especially in aquaculture, is lagging behind. Particularly in the area of precision aquaculture, the existing technology for monitoring energy use is underutilised. There is a need for installing systems that could enable individuals to track and adapt their energy usage. The difficulty lies in the lack of effective implementation and utilisation of digitalisation tools, hindering progress in energy monitoring and management within the aquaculture sector.
    - There could be a lot more research, innovation, and solutions provided in the area of alternative fuels.
- **Financial constraints.** Identification of financial constraints as the main challenge indicates the difficulty of securing resources for implementing energy transition technologies. Additionally, investing in new technologies entails significant risk, and most owners cannot afford losses of this kind in their investments.
- **Legislative barriers.** Legislative barriers, including harmful subsidies, and limitations in the capacity of the fleet present additional challenges that hinder the sector's development. Particularly, the **gross tonnage limitations should be revised** – it is suggested that crew space allocation should not be included in gross tonnage limitations. It is also recommended that gross tonnage be recalculated for new technologies (capacity needs to be adapted to new fuels).
- **Technology relevance and adaptation**. **Uncertainty about the future relevance of technologies** and the fast-paced nature of innovations pose challenges for adaptation within the fisheries and aquaculture sectors.
- **Infrastructure gaps and access challenges**. The lack of infrastructure emerges as a major issue, especially in smaller ports. This puts vessels without easy access to larger ports at a disadvantage, impacting the overall implementation of energy transition technologies.
- **Testing and prototyping.** Despite available technology, the call for more testing and prototyping indicates a need for practical experimentation, especially concerning changes in bunker capacity. Real-world testing, especially on board vessels, is deemed crucial for the relevance of technologies. Effective coordination between fisheries, aquaculture, maritime users, and land facilities is highlighted as a key factor.
- **Need for a differentiated approach.** A differentiated approach is deemed necessary for decarbonising the fleet, due to diverse vessel types and sectors. The lack of clarity on available decarbonisation technologies and the **old age of the fleet** present an additional challenge. Retrofitting engines is impossible without renewing the entire fleet.
- **Training and certification standards**. Training and certification standards for adopting new technologies should be developed.
- **Need for improved visibility and attractiveness of the sector**. To move forward effectively, there is a requirement for a better reputation to support skill development and attract young people. Additionally, there is a potential issue related to an aging workforce, which can be addressed through increased attractiveness and engagement in the sector to attract younger individuals.
- **Need for a uniform shipping platform** that enables incremental innovation to be built upon the base platform. This platform should also facilitate economies of scale, akin to the model observed in the aerospace industry, particularly Airbus, which established a complete supply

chain of components. The automotive industry has also adopted the same approach. For example, Stellantis utilises standard wheelbases for different vehicle propulsion systems to mitigate development risks.

Breakout session II: Technological and innovation solutions & possible actions:

- **Increase funds and incentives** to alleviate the financial barriers hindering the implementation of existing technologies. Particular attention and priority in receiving financial support should be given to the more vulnerable aspects of the sector, such as small-scale fisheries.
- **Enhance knowledge of energy use** in both land-based and marine aquaculture, as well as in fisheries, through monitoring, data processing, and the integration of new sensors. This approach would ultimately enable the enhancement of system digitalisation, such as precision fish farming, leading to a reduction in the cost per landing in fisheries.
- **Academia should be encouraged to support the development of appropriate metrics for assessing, monitoring, and reporting greenhouse gas (GHG)** emissions from fishing activities across the value chain. These metrics would be essential for accurately understanding the environmental impact of fishing practices.
- Efforts should be made to **quantify the impact of fishing on EU marine carbon stores**, including the carbon storage capacity and disturbance sensitivity of marine habitats, as well as the impact on the biological carbon pump in EU coastal zones. This data would be crucial for informed decision-making regarding conservation and sustainability.
- **Focus on education and training**. A crucial aspect highlighted was the significance of education and training. The goal should be to ensure widespread awareness and understanding among all stakeholders, including the private sector, policy makers, and fisheries. By prioritising this collective educational effort, stakeholders could be effectively prepared for impending changes, particularly the introduction of new tools and implementations within the context of the energy transition. Additionally, training and certification companies would need to support fishers by offering training programs to adopt new technologies and practices.
- **Endorse a consumer perception certification,** which involves certifying products based on consumers' perceptions of environmental and sustainable qualities. These measures could serve as influential drivers for securing a premium price. This, consequently, would provide additional incentives for producers to actively engage in the decarbonization of the sector.
- Long-term strategy should be focused on the comprehensive **overhaul and reassessment of infrastructure**, particularly within ports.
- **Development of international lifecycle guidelines and sustainability criteria for biofuels and alternative fuels**. These guidelines would be necessary to ensure that the adoption of such fuels aligns with sustainability goals.
- **Fishers should be encouraged to actively participate in consultations on the drafting of national and EU policy plans**. Additionally, piloting technological improvements under the European Maritime and Fisheries Fund (EMFAF) should be promoted, with a focus on enhancing selectivity and exploring alternative propulsion methods, such as electrified batteries.
- **Legislation and regulation**
    - **Enforce alternative legislation** that may allow for increased circularity within fisheries and aquaculture. This could involve measures aimed at providing greater flexibility, fostering innovation and adaptability in the respective industries.
    - **Utilise existing regulation**. The use of existing regulations, such as Article 17 of the Common Fisheries Policy, as a solution to support decarbonisation was mentioned. Leverage existing regulations, such as Article 17, to encourage decarbonisation efforts,

particularly through quota allocation favouring those employing more sustainable fishing practices.

    - **Develop roadmaps**. the European Commission and national governments should develop roadmaps with binding milestones and steps to address the impact of fishing on climate change, encompassing the impact from fuel emissions to ocean carbon. Additionally, developing and implementing a monitoring system to track progress across Member States is crucial.
    - Ensure that fishing is not exempt from EU carbon pricing.

- Explore the **integration of photovoltaics for oxygen generation in freshwater aquaculture**, with the potential to achieve a 50% reduction in emissions.
- Particular attention should be given to the **implementation of digital twins**. This approach should aim to utilise knowledge-based and data-driven models for a deeper understanding of stocks in aquaculture facilities, potentially extending to beneficial effects on stocks in coastal fisheries.
- **Pilot projects**. It was emphasised that pilot projects play a crucial role in identifying effective strategies and determining scalability. Pilot projects should be prioritised for assessing and implementing successful decarbonisation measures.
- **Enhance catchability[1] and selective fishing**. The need to improve the catchability of stocks through more selective fishing practices, ultimately ending overfishing, was discussed. Efforts should be directed towards promoting selective fishing methods to enhance the sustainability of the sector.
- **Develop a shared vision**. It was emphasised that stakeholders need to be consulted and actively contribute to forming a shared vision. Stakeholders should be engaged in the development of a shared vision to ensure broad support for decarbonisation efforts.
- **Wind farms as battery-charging stations**. The utilisation of wind farms as battery charging stations for vessels was suggested. This strategy involves implementing batteries on board and potentially using wind farms as charging stations in the future.
- **Leverage innovations in the shipping industry**. The exploration of innovations in the shipping industry, particularly regarding the implementation of batteries on board was suggested. The idea is to piggyback on the advancements made by the shipping industry, which is considered a significant player in the sector.
- **Collaboration with business angels and large businesses** for investing in new solutions, emphasising the importance of private and public partnerships.
- Implementation of **interregional collaboration**, utilising communities of practice and smart specialisation as tools to support collaborative innovations across regions and sectors.
- **Synergies identified**:
    - **Synergies between aquaculture and fisheries** sector encompass solutions aimed at reducing emissions and facilitating the exchange and processing of seafood products. This would include optimising the feeding of farm fish.
    - **Synergies between land-based aquaculture and agriculture** include feed production and the utilisation of fish waste and wastewater for fertiliser production.

[1] "Catchability" refers to the likelihood or ease with which a particular species of fish or marine organism can be caught by fishing gear or methods. It encompasses various factors such as the behaviour of the species, the efficiency of fishing gear, environmental conditions, and fishing effort. Quantitatively, the fraction of a fish stock that is caught by a defined unit of the fishing effort.

- **Synergies focused on reducing energy consumption in packaging and processing.** Specific areas include:
    - **Packaging materials.** It was recommended to transition from fossil fuel-based production materials for fish boxes and packaging materials.
    - **Biodegradable materials.** The use of marine biodegradable materials for ropes, moorings, and structures in both aquaculture and fisheries was recommended.
    - **Water-driven energy**. The exploration of water-driven energy sources, particularly in offshore or high-energy area aquaculture, would be recommended, utilising the water movement beneath aquaculture facilities.
    - **Development in batteries**. Ongoing developments in batteries, including efficiency and storage capacity, were highlighted. It is recommended to explore the potential for recharging at sea for certain vessels and further advancements in battery technology to enhance autonomy for vessels and onboard equipment.
    - **Other synergies identified include**: synergies within the supply chain (transporters, auctions); synergies between small-scale fisheries and aquaculture (could solve space problems); the small-scale fleet may adopt technologies from the automotive sector; large scale and distant water fleet may adopt technologies from cargo shipping and aeronautics sectors.
- **The fishing sector can benefit from adapting technologies from other industries for use in fishing vessels**. This adaptation requires technology transfer, necessitating the involvement of key entities in shipbuilding and energy sectors in energy transition projects/studies for fisheries. Real collaboration between these sectors and the fishing/aquaculture sector is essential for successful implementation.

- **Other solutions identified:**
    - Synthetic fuel produced with renewable energy is the most feasible technology to implement because it does not require modifications to the engine.
    - Improve fishing gears and energy audits through data analysis.
    - Scaling up of technologies and uptake – in-vivo implementation.
    - Create a risk-free environment with room for error (trial and error) – a call for 100% commitment from the EU to buy, install, and run gear and innovation, which is in line with the actions identified in the Communication of the Commission, to explore the possibility to create living labs in the EU.
    - Ensure that fleets (at the Member State level) receive advantages in terms of international competitiveness. This could involve policies or measures that support these fleets in competing effectively in international markets.
    - Region-specific solutions could be explored (e.g., in the Baltic Sea).

Follow UP Actions

After the event, participants were encouraged to provide further feedback in writing, after “digesting” the issues discussed in the breakout session. An online form with the same questions asked during the event was made available online for sharing further food for thought.

Annex 1 - Agenda

8h30 – 9h00	*Registration & Welcome coffee*
9h00 – 9h30	Welcome and introduction to the day (Moderated by Stephen DAVIES (DG MARE) Icebreaker Introduction to the challenge of research and innovation
9h30 – 10h30	Presentations: ○ Techno-economic analysis for the energy transition of the fisheries and aquaculture sector – Ecorys ○ Living Labs - ENoLL ○ Research and Innovation in Waterborne transport - The Waterborne Technology Platform V.Z.W. ○ Innovation in the Sustainable Blue Economy Partnership ○ Project examples in AZTI
10h30 – 10h50	*Coffee break*
10h50 – 11h30	Breakout session A: Identification of technological and innovation challenges & research gaps
11h30 – 12h15	Breakout session B: Identification of technological and innovation solutions & possible actions
12h15 – 12h50	Presentations of Conclusions and Recommendations by the groups
12h50 – 13h00	*Closing, incl. Next Steps*
13h00 – 14h00	*Light lunch networking*