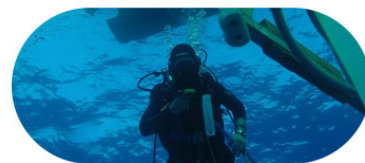


# Ocean-based Negative Emission Technologies



<b>Deliverable 2.3</b>	<b>Summary report on Workshop 1 on governance for ocean-based negative emissions technologies</b>
Lead	IASS
Related Work Package	WP 2
Related Task	Task 2.2
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<p><b>Abstract:</b> Research undertaken in Task 2.2 identified a range of governance challenges to ocean-based NETs related to the global ocean governance framework, e.g., linked to the transboundary nature of the ocean, potential effects of ocean-based NETs on the ocean’s condition and marine ecosystem services, as well as the many unknowns and uncertainties linked to NET-deployment. The fragmented approaches and frameworks in place to govern the global ocean further complicate comprehensive governance of these emerging technologies. This deliverable presents results from a workshop that explored how ocean-based NETs should be governed to best confront these challenges and integrate international climate targets as well as global goals for ocean and biodiversity conservation, in addition to global ambitions towards sustainable development. The workshop is part of research undertaken by Task 2.2 to assess how ocean-based NETs are addressed by the current global ocean governance framework and develop governance scenarios and recommendations to policy makers for a “good governance” of NETs in the ocean.</p>	



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## Document History

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## List of abbreviations, acronyms and definitions

AOSIS	Alliance of Small Island States
CBD	Convention on Biological Diversity
CDR	Carbon dioxide removal
EU	European Union
IASS	Institute for Advanced Sustainability Studies
ICES	International Council for the Exploration of the Sea
IMO	International Maritime Organisation
IOC-UNESCO	Intergovernmental Oceanographic Commission of UNESCO
IUCN	International Union for the Conservation of Nature
LC/LP	London Convention / London Protocol
NETs	Negative emissions technologies
NGO	Non-governmental organisations
SDG	United Nations Sustainable Development Goals
UNCLOS	United Nations Convention on the Law of the Sea
UNFCCC	United Nations Convention for Climate Change
UN-WOA	United Nations World Ocean Assessment
WP	Work Package
WWF	World Wildlife Fund

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## 1. Introduction

### 1.1 Context

OceanNETs is a European Union project funded by the Commission's Horizon 2020 program under the topic of Negative emissions and land-use based mitigation assessment (LC-CLA-02-2019), coordinated by GEOMAR | Helmholtz Center for Ocean Research Kiel (GEOMAR), Germany.

OceanNETs responds to the societal need to rapidly provide a scientifically rigorous and comprehensive assessment of negative emission technologies (NETs). The project focuses on analyzing and quantifying the environmental, social, and political feasibility and impacts of ocean-based NETs. OceanNETs will close fundamental knowledge gaps on specific ocean-based NETs and provide more in-depth investigations of NETs that have already been suggested to have a high CDR potential, levels of sustainability, or potential co-benefits. It will identify to what extent, and how, ocean-based NETs can play a role in keeping climate change within the limits set by the Paris Agreement.

### 1.2 Purpose and scope of the deliverable

OceanNETs work package 2 (WP2) "Governance, policy and international law" addresses the public and governance responses to ocean-based NETs. Task 2.2 of WP2 specifically focuses on the global ocean governance framework surrounding ocean-based NETs and investigates responses, challenges, and opportunities on the regional to international level for governing ocean-based NETs. The work involves identifying key barriers and synergies for ocean-based NETs within current and possible future ocean governance regimes and deriving recommendations for "good governance" of ocean-based NETs. The findings of a governance framework analysis for ocean-based NETs, performed during the first year of Task 2.2's research programme, set the foundation to identify the main current regional and global ocean governance challenges for comprehensive and good governance of the proposed technologies.

Task 2.2 combines desk-based research with a transdisciplinary approach that includes two dialogue workshops with key stakeholders as part of the research process; these aim to co-create a deliberative knowledge base on the current governance framework and to develop recommendations towards a "good governance" of NETs in the ocean. The first dialogue workshop was held on 4<sup>th</sup> May 2022 and invited participants to discuss options for "good governance" responses considering the identified challenges, the results of which are presented within this Deliverable 2.3. The workshop was held as an online workshop and included interactive elements to foster dialogue and a joint discussion. It brought together over 30 international experts from different fields related to ocean governance (see Table 2) to allow for sharing and compiling of a wide range of knowledge and perspectives.

The results from this workshop will feed into the further research process of Task 2.2 which ultimately aims to develop insights for EU and global policy makers on how governance could respond to persisting challenges identified for both ocean-based NETs and the governance framework in place. Task 2.2 hereby sets a focus on the global ocean

governance framework and the related challenges, gaps and opportunities towards governance of ocean-based NETs.

### 1.3 Relation to other deliverables

The results of Task 2.2 workshop 1 will feed directly into Task 2.2's Deliverable 2.5 "Report on regional and global governance challenges and opportunities for emerging ocean-based NETs" as well as Deliverable 2.6 "Policy brief identifying challenges and opportunities for emerging ocean-based NETs in regional and global ocean governance frameworks" that will be tailored to EU and global policymakers. Further, the identified knowledge and expertise from this first workshop will deliver input for the further research conducted in Task 2.2, including for the preparation and conducting of the second dialogue workshop that focuses on future governance scenarios for ocean-based NETs (Deliverable 2.4).

## 2. Online Workshop "Governance of ocean-based Negative Emissions Technologies"

### 2.1 Introduction

Pathways published by the Intergovernmental Panel on Climate Change for the timely achievement of climate targets set under the Paris Agreement, especially the 1.5°C goal, demonstrate a potential need to remove excess carbon dioxide (CO<sub>2</sub>) from the atmosphere in the future and create so-called "negative emissions". A range of technological options that aim to enhance the natural function of the earth's ecosystems to sequester and store additional carbon has been proposed for the purpose of carbon dioxide removal, including through ocean-based negative emissions technologies (NETs). In Task 2.2 of the OceanNETs project, an analysis of the global ocean governance framework was undertaken to determine the (direct and indirect) governance framework in place for NETs in the ocean. For this purpose, a literature review was conducted for eight different ocean-based NETs and complemented by an expert survey conducted among the OceanNETs consortium partners first to determine their effects on the ocean's biogeochemical condition and linked positive and negative impacts on coastal and marine ecosystem services. This knowledge laid the groundwork for determining the direct and indirect ocean-related governance dimension of the technologies.

First results from this research on the global ocean governance framework relevant to ocean-based NETs has identified a range of governance challenges. These include challenges linked to the transboundary nature of the ocean, potential effects of ocean-based NETs on the ocean's condition and thereby induced side-effects on ecosystem function and services, as well as the many unknowns and uncertainties linked to NET-deployment e.g., under the future effects of climate change. The fragmented approaches and frameworks in place to govern the global ocean further complicate comprehensive governance of these emerging technologies. Task 2.2's first of two dialogue workshops within the OceanNETs project aimed to identify what should be considered for the "good governance" of such technologies in the ocean (see Textbox 1 on good governance). The

workshop will help to identify governance options to better address the identified governance challenges in the ocean. Further, the workshop explores how ocean-based NETs should be governed synergistically to best integrate international climate targets as well as global goals for ocean and biodiversity conservation in addition to socio-economic ambitions towards sustainable development.

The results of workshop 1 will be used to develop guiding principles for ocean-based NET governance to EU and global policy makers. They further offer the option for a gap analysis between how ocean-based NETs are governed today on the regional to international level and what workshop participants identified as “good” approaches for governing the technologies, which could support the development of governance pathways which will be explored in the second workshop to be held under Task 2.2.

### Textbox 1: What is 'good governance' of ocean-based NETs?

In 1989, the World Bank published a report<sup>1</sup> that first introduces the concept of good governance and describes the particular approach to governance as “a public service that is efficient, a judicial system that is reliable, and an administration that is accountable to its public” for the main objective of overcoming economic crisis. Since, the idea of good governance has been often reiterated for different purposes, most frequently in application of national or supranational agencies for the achievement of sustainable development<sup>2</sup>. In addition, agencies such as the United Nations Development Programme<sup>3</sup> and the Council of Europe<sup>4</sup> have each published a list of ‘good governance principles’ which highlight the main factors that determine governance as ‘good’, and which can help to assess the effectiveness of good governance for the identified desirable outcome.

The previously proposed definitions and principles for “good governance” were intended for specific topics and governance levels. The perspective of the ocean and the marine environment is taken, from the international/global level, to draw conclusions for good governance from the unique challenges that the introduction of a new use within the ocean realm under a changing climate poses. An analysis of the effects of ocean-based NETs on the ocean’s condition and linked ecosystem services has determined that none of the considered technologies is without secondary effects to the marine environment or society. While the deployment of ocean-based NETs will likely be unable to exclusively generate positive outcomes for the environment and society, governance of the technologies may ensure the best possible outcome across global goals. We consider the concept of “good governance” to assist in the determination of parameters to achieve this “best possible outcome” for humanity in the deployment of the technologies, and to this end further contemplate the uniqueness of the marine environment and ocean governance.

## 2.2 Workshop organisation

The workshop was planned and held as an online event via the video conferencing platform Zoom. The event was publicised via the organizer’s website<sup>5</sup>, however, participants were predominantly purposively selected based on their expertise and invited via personalised email invitation that included a short concept note and abbreviated agenda for the span of 3.5 hours (see full material provided to participants in the Annex). Suggestions from invitees for further participants or substitutes when the invited experts were unable to attend were largely accepted. The workshop started at 14:00 Central European Summer Time (CEST) to allow for a wide range of international participants to join. Registration for the workshop was possible via the online event-software Eveeno, by which participants gave their personal information (Name, Institution, Email) and could agree to their details being published on a participants list to be shared among attendees and a strict data privacy

<sup>1</sup> *Sub-Sahara Africa: From Crisis to Sustainable Growth – A Long-Term Perspective Study* ([link](#))

<sup>2</sup> Khandakar Qudrat-I Elahi, (2009), "UNDP on good governance", *International Journal of Social Economics*, Vol. 36 Iss 12 pp. 1167 - 1180

<sup>3</sup> UNDP 2011: *Towards Human Resilience: Sustaining MDG Progress in an Age of Economic Uncertainty*. Chapter 8 “Governance Principles, Institutional Capacity and Quality”: 268-290 pp.

[https://www.undp.org/sites/g/files/zskgke326/files/publications/Towards\\_SustainingMDGProgress\\_Cover\\_TO\\_C.pdf](https://www.undp.org/sites/g/files/zskgke326/files/publications/Towards_SustainingMDGProgress_Cover_TO_C.pdf)

<sup>4</sup> Council of Europe (2007) Resolution 239 (2007) European Strategy of Innovation and Good Governance at Local Level endorsed at Valencia Ministerial Conference 2007 <https://rm.coe.int/1680746d1d>

<sup>5</sup> <https://www.iass-potsdam.de/de/veranstaltungen/governance-ocean-based-negative-emission-technologies>

notice, in line with the EU's data privacy standards. Registered individuals received an email with extended informative material a week prior to the workshop that included background information on the topic of ocean-based NETs, details on the aim of the governance workshop, an extended agenda with details on presentations and break-out groups (see Table 1 below) and a participants list to set the scene for an inclusive dialogue space.

Table 1: Extended workshop agenda sent to registered participants prior to workshop

Time (CEST)	Program Elements
13:45 – 14:00	Arrival of participants
<b>14:00 – 15:15</b>	<b>Welcome and Introduction</b> <i>moderated by Barbara Neumann, IASS</i>
14:00 – 14:10	Start of workshop and introduction <i>Barbara Neumann</i>
14:10 – 14:15	Welcome note <i>Mark Lawrence, Institute for Advanced Sustainability Studies (IASS)</i>
14:15 – 14:25	Introduction to the OceanNETs project <i>David Keller, GEOMAR Helmholtz Centre for Ocean Research</i>
14:25 – 14:45	Ocean alkalization <i>Andreas Oschlies, GEOMAR Helmholtz Centre for Ocean Research</i>
14:45 – 15:00	Ocean governance and ocean-based negative emissions technologies <i>Lina Röschel, IASS</i>
15:00 – 15:15	Short Q&A
<b>15:15 – 16:30</b>	<b>Break-out Group Discussion</b>
	In two parallel break-out groups, we will discuss how ocean-based NETs ought to be governed in the ocean realm, at global and regional scale, to address challenges such as transboundary issues and matters of scope and scale, including stakeholder involvement and power relations, and information and data requirements.  <i>The discussion groups will be moderated by (1) Lina Röschel and Ben Boteler, IASS, and (2) Barbara Neumann and Sebastian Unger, IASS.</i>
16:30 – 16:45	Short break
<b>16:45 – 17:30</b>	<b>Plenary Discussion &amp; Closing Remarks</b> <i>moderated by Lina Röschel, IASS</i>
	Reporting of key findings from the break-out groups, <i>Ben Boteler and Sebastian Unger</i> Reactions from the participants & joint discussion Key conclusions and closing remarks, <i>Barbara Neumann</i>



The workshop programme was developed to allow for five speakers (four from the OceanNETs project and one welcome note from the facilitating organization's scientific director) to give a range of short (15 minutes or less) informative impulses to later discussions.

The entire workshop was held under Chatham House Rules, under which workshop participants' information (name or affiliation) are not revealed in relation to particular comments made in an effort to increase the openness of discussion, which the workshop facilitation team deemed as beneficial to the widely debated, by some viewed as controversial, topic at hand. The presentations and discussions were thus not recorded except for written notes taken by the facilitation team, and workshop outcomes have been pseudonymised. Hence, a participants list will also not be made publicly available. To ensure the correctness and quality of the workshop outcomes nonetheless, participants were sent a draft of the workshop summary for review and feedback ahead of Deliverable submission (see Annex 3.3). There were no comments received that suggested changes or adjustments; all comments received expressed complete satisfaction with the provided summary. Feedback to the workshop itself was received via an EU-Survey sent to participants two days after the event to determine overall satisfaction with the workshop organisation and content (see survey results in section 2.4).

Speakers and presentation topics were selected based on the expectation that workshop participants would not need to be familiar with the topic of governance of ocean-based NETs but could receive all information needed to engage in discussions during the workshop. Profiles for each speaker can be viewed here:

- Barbara Neumann: <https://www.iass-potsdam.de/en/people/barbara-neumann>
- Mark Lawrence: <https://www.iass-potsdam.de/en/people/mark-lawrence>
- David Keller: <https://www.geomar.de/en/dkeller>
- Andreas Oschlies: <https://www.geomar.de/en/aoschlies>
- Lina Röschel: <https://www.iass-potsdam.de/en/people/lina-roschel>

As stated above, participants were not selected based on their experience with the technologies or the governance of thereof. The aim of the workshop was to engage a wide range of expertise and differentiated views on the topic of ocean-based NETs and their governance from different angles. The workshop specifically targeted experts from the fields of:

- **Ocean governance:** sustainable ocean governance, just ocean governance, governance of transformation of ocean industries, governance in areas beyond national jurisdiction, indigenous fishing rights, regional maritime governance, ocean and climate governance, UNCLOS;

- **Governance of negative emissions technologies (terrestrial and ocean-based):** good governance of geoengineering, governance of ocean-based NETs, scenario-based analysis of NET trade-offs, socio-economic impact modelling of NETs, carbon dioxide removal policy frameworks;
- **Marine ecosystem (services) governance, ecosystem-based management, marine ecology:** ecosystem service valuation and management, game theory, global commons, integration of ecosystem services into ocean governance, ecological modelling, flow of ecosystem services, ecosystem-based approaches, interactions between society and ocean, conflicts over marine resources, conservation and blue growth, management of marine resources under climate change;
- **Governance of emerging (ocean) issues:** regime shifts in socio-ecological systems, emerging global issues, ocean risks and resilience, deep seabed mining, sustainability transformations, environmental ethics of geoengineering, transitioning ocean governance;
- **Policy / decision-making expertise, NGOs:** policy makers / experts from European Commission, DG-Mare, DG-Env, European Environment Agency, UNFCCC, IMO, UN Global Compact, ICES, CBD, IOC-UNESCO, UN-WOA, AOSIS, IUCN, WWF, Sea Shepherd, etc.

In addition, OceanNETs partners from WP1 “Economic prospects and incentives”, WP2 “Governance, policy, and international law”, WP3 “Public perception”, WP4 “Simulations” and WP6 “Ocean alkalization case studies” were targeted to foster an inter-work package exchange amongst the OceanNETs consortium and to add expertise on diverse perspectives related to ocean-based NETs to the workshop discussions. The facilitation team, made up of the Task 2.2 lead and research associate and additional members of the Ocean Governance Research Group from the IASS, each served as expertise on ocean governance.

Individualised invitations were sent out to each identified expert to increase engagement (over 80% response rate). Over 75 experts were invited to the workshop, of which over 60% registered to participate. The workshop engaged up to 36 participants throughout, while there was some participant fluctuation between programme elements.

Registrants were allocated based on their expertise to one of the two break-out groups in advance of the event to allow for an even representation of knowledge fields. Each break-out group included around 15 participants and was serviced by a moderator, a rapporteur and a note taker provided by the facilitating organization IASS. Both groups were given three identical discussion topics with three prepared sub-questions each to discuss within the time span of 75 minutes (see Annex 3.2).

Table 2: Distribution of expertise in workshop participants

Expertise	Number of participants
Ocean governance	7
Governance of NETs	6
Marine ecosystem services, marine ecology	2
Governance of emerging issues	6
Policy/decision-makers/NGOs	7
OceanNETs partners	8

After the break-out group discussions, all participants met back in the virtual plenary for a final round of feedback, discussion and closing remarks. Rapporteurs gave brief five-minute recaps of the main points discussed in each group. A workshop summary produced based on the notes made by the facilitation team and the feedback received from workshop participants via email after the workshop is included in the next section.

## 2.3 Workshop summary

### *Presentations*

The workshop was opened by Barbara Neumann, Senior Research Associate at the Institute for Advanced Sustainability Studies (IASS) and lead of Task 2.2 of the OceanNETs project. After welcoming the workshop participants, she provided a background and introduction to the topic and agenda of the workshop. She briefly presented results from a first-order assessment of the ocean-related governance framework which can be described as a set of regulations and frameworks directly and indirectly referring to, or potentially being affected by, negative emissions technologies (NETs) in the ocean, and then explained the direction of this workshop: the exercise would be to detach from the formal governance structure in place and look at what is needed for a “good governance” of NETs in the ocean, at global and regional scale, addressing aspects such as stakeholder involvement and power relations, potential trade-offs and benefits between goals and policy integration, social and ethical dimensions of NET deployment, or information and data requirements. Participants were further informed that the workshop will contribute to the overall project research and ultimately to develop recommendations for policymakers through follow-up research.

The introduction was followed by a welcome note by Mark Lawrence, Scientific Director at IASS. Pointing towards the potential opportunities of NETs to help meet climate goals, as well as to the limitations to reach climate relevant removal of CO<sub>2</sub> from the atmosphere within the next decades, he emphasised the importance of addressing governance questions in the overall discussion, to which this workshop contributes.

David Keller, Senior Research Scientist at the GEOMAR Helmholtz Centre for Ocean Research in Kiel, Germany, and coordinator of the OceanNETs project, then introduced the overall aim and research of the OceanNETs project. He briefly described the NET approaches researched within OceanNETs as well as the advances and knowledge gaps addressed by the project. Andreas Oschlies, Head of Research Unit Biogeochemical Modelling at the GEOMAR Helmholtz Centre for Ocean Research Kiel and member of the OceanNETs research consortium, then presented the concept of Ocean Alkalinity Enhancement / Ocean Alkalinization. He explained the natural CO<sub>2</sub> removal mechanism of chemical weathering of rocks, and how this mechanism can increase alkalinity of ocean waters, allowing the ocean to store a higher amount of CO<sub>2</sub>. He further explained how such alkalinity enhancement could be achieved in the ocean by adding carbonate-containing minerals such as limestone or alkaline solutions via e.g., desalination plants to the ocean water, but also referred to challenges such as the high amount of necessary available resources, infrastructure and high cost currently associated with the NET.

Lina Röschel, Research Associate with the Task 2.2 team of the OceanNETs project at IASS, presented the main ocean governance challenges related to ocean-based NETs. She shortly introduced the current international regulatory framework around ocean-based

NETs, including the London Convention and Protocol as well as the Convention on Biological Diversity, and argued that, while a framework is in place to govern NETs, it may not be fit to respond to open challenges. For one, the transboundary nature of the ocean was named as a challenge to comprehensive governance as potential effects of ocean-based NETs may travel from their initial entry point. Further, it was argued that the many unknowns and uncertainties surrounding the deployment of such technologies in the ocean as well as climate change need to be integrated into governance rather than causing “policy paralysis”. A holistic approach to governance may be needed to address the potential co-benefits and trade-offs associated with the deployment of ocean-based NETs to avoid that global policy goals are pitted against each other.

A short Q&A round provided participants with the opportunity to ask questions or make comments on the on the presentations before the participants were invited to move over and continue in two moderated breakout groups.

### *Break-out group discussions*

Distributed across two breakout groups, participants were invited to jointly identify and discuss what governance of ocean-based NETs ought to entail to adhere to the targets set by the Paris Agreement, but further stay on path for additional global policy goals, such as SDG 14 “Life Below Water” set by the 2030 Agenda of the United Nations from an ocean point of view and relating to marine governance issues. The parallel group discussions were organised along three overarching topics to which the facilitators provided a brief introduction before opening the discussion. Participants were encouraged reflect on these aspects of governance along the example of the ocean-based NET of Ocean Alkalinity Enhancement / Ocean Alkalinization, presented earlier by Andreas Oschlies, to provide context to the discussion.

### *Stakeholders, roles and positions*

The first discussion topic was dedicated towards identifying the most relevant stakeholders for ocean-based NET governance, as well as their potential roles and positions within ocean-based NET governance. The intention was to gain insights from the participants’ different fields of expertise on who should be involved in decision-making (and which stakeholders should not), what roles these stakeholders should take one (e.g., regulatory, knowledge provision, technical support, feedback, etc.), and how to best include a diverse spectrum of stakeholders in decision-making processes in a comprehensive and fair manner. These insights would give the Task 2.2 team indication on what aspects of stakeholder involvement need to be included to ensure “good governance” of ocean-based NETs.

This first round of the breakout group discussions considered three sub-questions:

- What are relevant stakeholders to ocean-based NET governance?

- What roles should stakeholders take within a governance framework for ocean-based NETs?
- What are options for comprehensive and fair decision-making?

In the breakout groups, the importance of international governance agencies and bodies already active in regulating ocean-based NETs, such as the International Maritime Organization (IMO) via the London Convention and London Protocol (LC/LP) and the Convention on Biological Diversity (CBD), including through secretariats and scientific advisory bodies, was stressed. The workshop raised the importance of political negotiations within these existing governance structures in order for the governance process for ocean-based NETs to move along and to address open issues. In addition to these highly relevant law-making bodies, as well as the supporting intergovernmental organizations and State parties, it was discussed that further stakeholders, e.g., from science, the general public and actors from the private sector ought to be included for comprehensive decision-making processes with regards to ocean-based NETs. Specifically, an intergenerational representation and an eco-centric perspective were addressed as important aspects for stakeholder identification and integration, and the inclusion of vulnerable groups and indigenous communities impacted by climate change. Moreover, it was also noted that marine life is often overlooked as a primary stakeholder to ocean-based NET governance, and the difficulty of appropriate representation of individual species and ecosystems, as well as their complex reactions to the technologies remains a challenge. Non-governmental organisations would need to take on the role as advocates for marine life and other underrepresented groups. It was noted that the land-ocean-connection plays a significant role for many of the proposed technologies also in terms of stakeholder engagement, e.g., inclusion of mining communities for ocean alkalization, as well as to limit blind spots in ocean governance and beyond. It was further noted that the range of stakeholders to be included might differ between NET type and that NETs might require individualized approaches to governance, and be determined by scale, location, or type of technology and governance approach, among others.

There was also a discussion whether to draw the realm of actors to be involved wider and include all those (positively and negatively) affected by the deployment or limitation of the technologies. Further, it was questioned if to include, e.g., carbon accounting agencies who provide the incentives to deploy NETs in the ocean, or industrial stakeholders. It was noted that not all actors that are affected by or interested in NET deployment should necessarily become part of governance or decision-making processes as this could end in deadlock when individual interests drive the debates. Generally, stakeholder mapping could provide a suitable approach to identify relevant actors for NET governance arenas, as well as a mapping of suitable/relevant types of governance. Stakeholders purely affected by voluntary action, such as those acting under the objective of pursuing profit, could be excluded from decision-making processes. While such a wide stakeholder integration into governance processes may be challenging to put into practice, it provides a good starting

point for good governance of ocean-based NETs, and it would provide a much greater challenge to change the governance system in place.

It was discussed that while the objective of wide participation in governance is ideally strived for, such ambitions may not be practical or easily implemented, as the success of stakeholder inclusion is not only met by good and inclusive policy processes but is also dependent on the willingness and availability for active participation of each stakeholder group. Capacity building and transparency in governance were identified as key components in governance of ocean-based NETs to ensure successful participation of different stakeholder groups in the future, especially in coastal zones, as well as including indigenous populations and communities with a high potential for being affected by the deployment of technologies, as well as those communities most likely impacted by the effects of climate change. Further it was noted that understanding the perception of NETs by stakeholders is important, as is the way governance discussions are framed. Wording such as “dumping” induces specific conceptions of the topic. It was also noted that such inclusive stakeholder involvement would not have to be burdened only by government bodies, but a mechanism could be put in place to involve non-governmental or intergovernmental organisations to ensure stakeholder mobilisation and engagement.

#### *Scope and scale of governance*

In the presentation on ocean governance and ocean-based NETs held by Lina Röschel, the workshop participants were presented with a variety of governance challenges associated with the deployment of the technologies. These included transboundary challenges, the challenge of decision-making under deep uncertainty, as well as the importance of minimizing trade-offs between global goals for comprehensive “good” governance of ocean-based NETs. After discussing which stakeholders should ideally be involved in decision-making processes, and how, the aim of the second discussion topic was to further analyse the identified governance challenges and discuss how governance could support in overcoming these challenges and gaps in the current governance framework for ocean-based NETs. Leading discussion questions included the following:

- How can transboundary effects of ocean-based NETs be approached to reflect “good governance”?
- What would “good governance” of ocean-based NETs need to entail to account for deep uncertainty?
- How can different policy goals be integrated? How to deal with possible trade-offs?

Potential transboundary effects of ocean-based NETs raised concerns over the monitoring systems in place for the ocean, which data is collected by which stakeholders, and the transparency of such data (also see section on *information and data* below). It was raised that integrating procedural tools such as environmental impact assessments and a set of principles into decision-making processes would be key to incorporate consideration of transboundary effects into governance and avoid unilateral action by a single party. In this

regard, the need to reflect different regimes for areas beyond national jurisdiction and within national jurisdiction was also mentioned as aspect for good ocean governance of ocean-based NETs. It was noted that an “Assessment Framework for Scientific Research” put in place by the Scientific Groups to the LC/LP provides criteria for an initial environmental assessment and monitoring for ocean fertilization and could be adapted for other ocean-based NETs.

Many uncertainties prevail in the deployment and governance of ocean-based NETs, so much so that it has been identified as a “wicked” challenge for which decision-making could never be truly risk free. At the same time, uncertainties should be further investigated to continue moving from “deep uncertainty” to a more “shallow uncertainty” that could be more easily managed by the governance frameworks in place. NETs may shift baseline scenarios for climate change in the coming years, which needs to be properly integrated into decision-making around these technologies. An adaptive approach to governance of ocean-based NETs that includes foresight and is thus more resilient against future unforeseen shocks to the system, e.g., wars, is the foundation for dealing with uncertainties. The precautionary principle was identified as the foundational guiding principle under uncertainty for decision-making related to ocean-based NETs, substantiated by environmental impact assessments and monitoring. The precautionary principle would perhaps have to be further developed and effectively implemented to avoid acting as a barrier, including to research, as uncovering of uncertainties is a part of science and innovation. It was agreed that a decision-making lock-in or “policy paralysis” due to prevailing uncertainties around the technologies would need to be avoided in order to overcome gaps in the governance framework. An added layer of complexities towards dealing with transboundary effects and uncertainty is provided by the fragmented nature of ocean governance framework, in which separate regimes would apply for different NET activities and impacts, and in conjunction with other governance frameworks, such as that for climate change.

It was determined that a more integrative approach between policy silos would benefit comprehensive governance of ocean-based NETs, and that a “sustainability lens” could provide a suitable framework for dealing with trade-offs. The governance of these technologies may add another sectoral layer to ocean governance, as the technologies intend to support global climate ambitions, but may affect biodiversity and environmental goals as well as other maritime sectors. Deep sea-bed mining as emerging ocean governance challenge provides us with an example of an ocean activity governed by a single agency (the International Seabed Authority) that is lacking interlinkages with other sectoral governance. As ocean-based NETs collide ocean governance with climate governance (amongst other governance frameworks), an integrated approach of different governance regimes working together on this topic may be beneficial. It was further emphasized that there is an urgent need for a framework to govern NETs in the ocean, with robust processes and globally agreed principles, and guidance for good practices and management of NET deployment. It might not necessarily require a legally binding framework, but procedural tools alone might not be sufficient. The question was raised



whether a more comprehensive approach is required, and recourse to procedures and transparency, to achieve “good governance”, while other voices raised concern that adding further complexity to governance can also be risky.

### *Information and data*

The third sub-topic discussed with workshop participants looked at information and data requirements to enable and support good governance of ocean-based NETs. Along Ostrom’s IAD Framework, indicators such as available information for decision-making, information flow, authorization of information, obligations on communication, and more, are used to describe the individual conditions under which governance interactions happen. Inspired by this approach, this discussion aimed to identify what information would be required to make “good” governance decisions surrounding ocean-based NETs, as well as the parameters around how and by whom this information should best be provided. The discussion was led by three guiding questions:

- What information is needed for comprehensive decision making?
- How should information be integrated into decision-making?
- Should there be rules for information provision, access and sharing, monitoring etc.?

To make sustainable and inclusive decisions for ocean-based NETs, it was determined that a wide range of environmental, socio-cultural and socio-economic data, including information on their interlinkages and compounding effects, are needed. This data would need to be of good quality, transparently available in an understandable format that is easy-to-use for different target groups, and easily accessible for governance, science and society. It should also be available in a unified format that is comparable to other available ocean data to better close knowledge gaps.

Sharing of data was mentioned as a key component to good governance of ocean-based NETs, as data from coastal areas often lacks such availability. This was particularly relevant since NET deployment would primarily take place in along coastlines. It was noted that private industry gaining potential profits from deployment of ocean-based NETs should not be in charge of producing their own monitoring data, but that governments or independent oversight via intergovernmental agencies or separate private companies are crucial to ensure good provision of information and data. Regulations should in addition be put in place to determine which data is needed at what time scales, etc., to provide a structured and easily verifiable approach to data collection. Further, it was suggested that in addition to providing information on actions taken to mitigate climate change, it would be equally important to compile information on consequences of inaction and by that provide assessments of different options to support decision-making in the context of uncertainty.

## 2.4 Evaluation and Feedback

### *Workshop organisation*

Feedback collected via an EU Survey form indicated that participants were satisfied to very satisfied with the overall set up and organisation of the workshop, as well as the timing (dates, start / finish times), length and engagement of participants. The ‘informal friendly setting’ was complemented by one survey participant that appreciated how the discussions were ‘lively’ and ‘allowed for all to share views openly’. Individual responses to the survey indicated the wish for an in-person workshop rather than the online format, as well as a note that the first break should have been set earlier to allow for respite. Both suggestions will be taken up for the second Task 2.2. governance workshop that will, if the global health crisis allows, take place as in-person event at the IASS in Potsdam, Germany.

### *Workshop content*

The EU Survey results informed that participants were satisfied to very satisfied with the online workshop in terms of topics covered and points discussed. Survey participants indicated that they were likely to very likely to use what was learned in the workshop in future work. Especially the workshop presentations were appreciated and complemented by many participants for delivering new insights on the emerging topic of ocean-based NET governance, both in the EU Survey and via the Zoom chat function. The presentations were described as ‘amazing’ and ‘great’ by individual workshop participants while workshop as a whole was deemed as ‘interesting’ and ‘wonderful’ via the Zoom chat function.

### 3. Annex

#### 3.1 Material for participants: Workshop concept, agenda and participation list

## Governance of ocean-based negative emission technologies

### Online workshop

**Date:** Wednesday, 4 May 2022

**Time:** 14:00 – 17:30 CEST / 8:00 – 11:30 EDT

**Organiser:** Institute for Advanced Sustainability Studies (IASS), Potsdam, Germany

#### Background

Pathways published by the Intergovernmental Panel on Climate Change for the timely achievement of climate targets set under the Paris Agreement, especially the 1.5°C goal, demonstrate a potential need to remove excess carbon dioxide from the atmosphere in the future and create so-called ‘negative emissions’. A range of technological options that aim to enhance the natural function of the earth’s ecosystems to sequester and store additional carbon has been proposed for the purpose of carbon dioxide removal, including through ocean-based negative emissions technologies (“NETs”).

Within the EU-H2020 **OceanNETs project**, researchers aim to determine to what extent, and under what conditions, ocean-based NETs (see Figure 1) could contribute to achieving climate targets and stay within the limits set by the Paris Agreement. The research of Task 2.2 of OceanNETs in particular addresses the ocean-related governance dimension of these technologies. The aim is to identify how ocean-based NETs fit into the current global ocean governance framework, what should be considered for the good governance of the deployment of such technologies in the ocean, and to develop future governance scenarios.

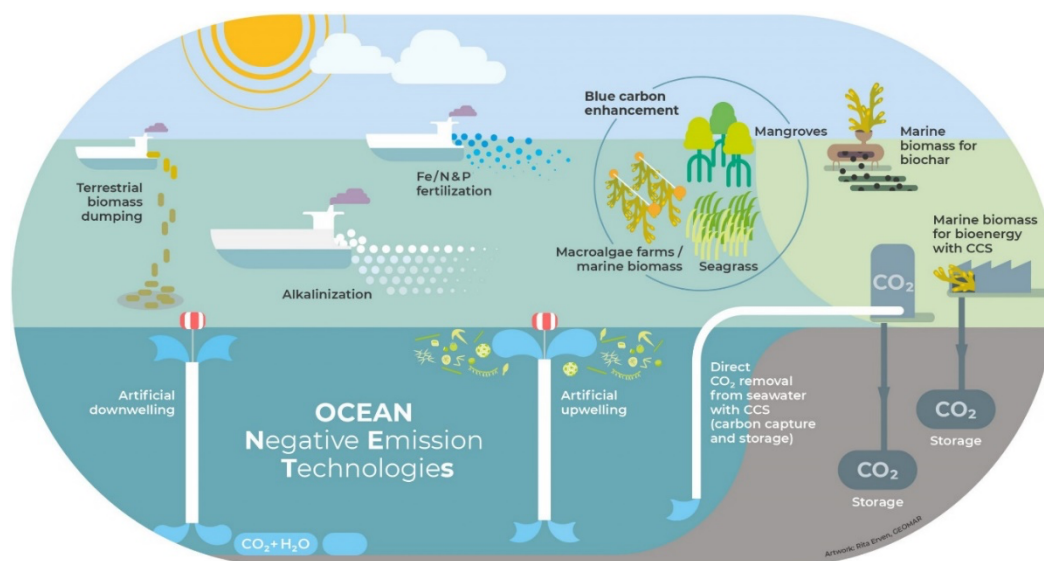


Figure 1: A range of ocean-based negative emissions technologies have been proposed for atmospheric carbon dioxide removal. Source: <https://www.oceannets.eu>, Artwork: Rita Erven, GEOMAR

### Aim of this online workshop

Research undertaken on the global ocean governance framework relevant to ocean-based NETs has identified a range of governance challenges. These include challenges linked to the transboundary nature of the ocean, potential effects of ocean-based NETs on the ocean's condition and thereby induced side-effects on ecosystem function and services, as well as the many unknowns and uncertainties linked to NET-deployment e.g., under the future effects of climate change. The fragmented approaches and frameworks in place to govern the global ocean further complicate comprehensive governance of these emerging technologies.

In this workshop, we want to present the identified governance challenges for ocean-based NETs and, together with workshop participants, explore how ocean-based NETs should be governed to best integrate international climate targets as well as global goals for ocean and biodiversity conservation, in addition to socio-economic ambitions towards sustainable development. Governance expertise on the ocean, marine ecosystem services, ecosystem-based management, emerging issues, NETs, geoengineering as well as expertise on policy and decision-making are gathered in the workshop to discuss this complex and emerging topic from different perspectives. The results of the workshop will contribute to the overall research within the OceanNETs project and specifically inform the production of a policy brief intended to reach European policy makers and beyond. A follow-up workshop to develop future governance scenarios of ocean-based NETs is planned for 2023.

### Contact

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## Agenda

Time (CEST)	Program Elements
13:45 – 14:00	Arrival of participants
<b>14:00 – 15:15</b>	<b>Welcome and Introduction</b> <i>moderated by Barbara Neumann, IASS</i>
14:00 – 14:10	Start of workshop and introduction <i>Barbara Neumann</i>
14:10 – 14:15	Welcome note <i>Mark Lawrence, Institute for Advanced Sustainability Studies (IASS)</i>
14:15 – 14:25	Introduction to the OceanNETs project <i>David Keller, GEOMAR Helmholtz Centre for Ocean Research</i>
14:25 – 14:45	Ocean alkalization <i>Andreas Oschlies, GEOMAR Helmholtz Centre for Ocean Research</i>
14:45 – 15:00	Ocean governance and ocean-based negative emissions technologies <i>Lina Röschel, IASS</i>
15:00 – 15:15	Short Q&A
<b>15:15 – 16:30</b>	<b>Break-out Group Discussion</b>
	In two parallel break-out groups, we will discuss how ocean-based NETs ought to be governed in the ocean realm, at global and regional scale, to address challenges such as transboundary issues and matters of scope and scale, including stakeholder involvement and power relations, and information and data requirements.  <i>The discussion groups will be moderated by (1) Lina Röschel and Ben Boteler, IASS, and (2) Barbara Neumann and Sebastian Unger, IASS.</i>
16:30 – 16:45	Short break
<b>16:45 – 17:30</b>	<b>Plenary Discussion &amp; Closing Remarks</b> <i>moderated by Lina Röschel, IASS</i>
	Reporting of key findings from the break-out groups <i>Ben Boteler and Sebastian Unger</i>
	Reactions from the participants & joint discussion
	Key conclusions and closing remarks <i>Barbara Neumann</i>



### 3.2 Breakout-group discussions

Slides presented by the moderators during the breakout-group to present the topics and prepare for discussion:

## Breakout group discussion



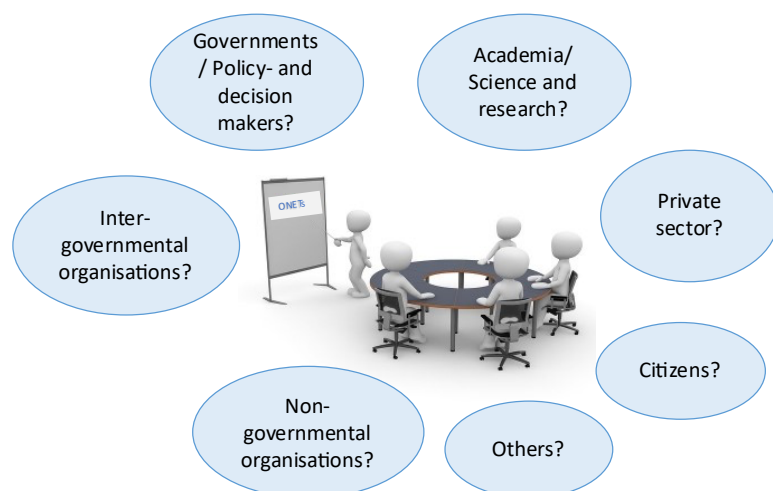
„Good governance“ of negative emission technologies in the ocean - overarching topics:

1. Stakeholders, roles and positions
2. Scope and scale of governance
3. Information and data

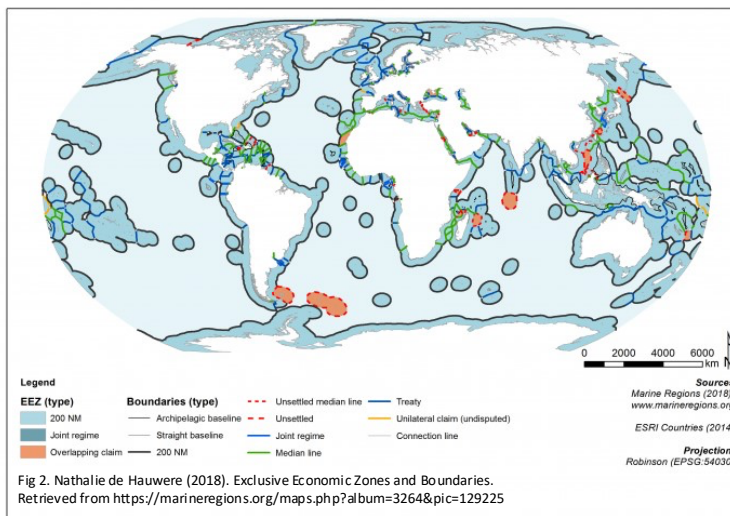
## 1. Stakeholders, roles and positions



- Who should be involved?
- What roles should they take within a ONETs governance framework?
- What options for comprehensive and fair decision-making?



## 2. Scope and scale of governance

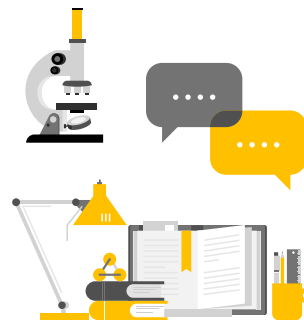


- How can transboundary effects be approached?
- How to account for deep uncertainty?
- How can different policy goals be integrated? How to deal with possible trade-offs?

## 3. Information and data



- What information is needed for comprehensive decision making?
- How should information be integrated into decision-making?
- Should there be rules for information provision, access and sharing, monitoring etc.?





### 3.3 Workshop summary shared with participants

The following workshop summary as shared with participants after the workshop for commenting:

## Governance of ocean-based negative emission technologies

Online workshop, 4 May 2022, 14:00 – 17:30 CEST / 8:00 – 11:30 EDT

### Workshop Summary

#### Aim and approach of the workshop

This online workshop was conducted by the [OceanNETs](#) project Task 2.2 team Barbara Neumann and Lina Röschel of the Institute for Advanced Sustainability Studies (IASS). It aimed to discuss with experts from different backgrounds and expertise what “good governance” of negative emissions technologies (NETs) in the ocean should entail. The workshop participants were presented with background information on a selected NET approach, Ocean Alkalinization / Ocean Alkalinity Enhancement, and with governance challenges for ocean-based NETs identified through initial research. In two break-out groups that were facilitated by the Task 2.2 team, workshop participants then explored how ocean-based NETs should be governed, at global to regional scale, to best address identified challenges such as transboundary issues, stakeholder involvement, or information and data requirements under the concept of “good governance” and integrate international climate targets as well as global goals for ocean and biodiversity conservation and sustainable development. The comments and discussion points brought up during the workshop, as summarised here, will feed into the further research of the team and within OceanNETs and build ground for elaborating recommendations to policy makers.

#### Agenda

Time (CEST)	Program
13:45 – 14:00	Arrival of participants
14:00 – 15:15	<b>Welcome and Introduction</b> <i>Moderated by Barbara Neumann, IASS</i>
	Welcome note <i>Mark Lawrence, Institute for Advanced Sustainability Studies (IASS)</i>
	Introduction to OceanNETs project <i>David Keller, GEOMAR Helmholtz Centre for Ocean Research</i>
	Ocean alkalinization <i>Andreas Oschlies, GEOMAR Helmholtz Centre for Ocean Research</i>

	Ocean governance and ocean-based negative emissions technologies <i>Lina Röschel, IASS</i>
	Short Q&A
<b>15:40 – 16:50</b>	<b>Break-out Group Discussion</b> <i>Moderated by (1) Lina Röschel and Ben Boteler, IASS, and (2) Barbara Neumann and Sebastian Unger, IASS.</i>
16:50 – 17:00	Short break
<b>17:00 – 17:30</b>	<b>Reporting Back &amp; Closing Remarks, moderated by Lina Röschel, IASS</b> Reporting of key findings from the break-out groups <i>Ben Boteler and Sebastian Unger</i>  Reactions from the participants & joint discussion  Key conclusions and closing remarks <i>Barbara Neumann</i>

### Welcome and introduction session

The workshop was opened by *Barbara Neumann*, Senior Research Associate at the Institute for Advanced Sustainability Studies (IASS) and lead of Task 2.2 of the OceanNETs project. After welcoming the workshop participants, she provided a background and introduction to the topic and agenda of the workshop. She briefly presented results from a first-order assessment of the ocean-related governance framework which can be described as a set of regulations and frameworks directly and indirectly referring to, or potentially being affected by, negative emissions technologies (NETs) in the ocean, and then explained the direction of this workshop: the exercise would be to detach from the formal governance structure in place and look at what is needed for a “good governance” of NETs in the ocean, at global and regional scale, addressing aspects such as stakeholder involvement and power relations, potential trade-offs and benefits between goals and policy integration, social and ethical dimensions of NET deployment, or information and data requirements. Participants were further informed that the workshop will contribute to the overall project research and ultimately to develop recommendations for policymakers through follow-up research.

The introduction was followed by a welcome note by *Mark Lawrence*, Scientific Director at IASS. Pointing towards the potential opportunities of NETs to help meet climate goals, as well as to the limitations to reach climate relevant removal of CO<sub>2</sub> from the atmosphere within the next decades, he emphasised the importance of addressing governance questions in the overall discussion, to which this workshop contributes.

*David Keller*, Senior Research Scientist at the GEOMAR Helmholtz Centre for Ocean Research in Kiel, Germany, and coordinator of the OceanNETs project, then introduced the overall aim and research of the OceanNETs project. He briefly described the NET approaches researched within OceanNETs as well as the advances and knowledge gaps addressed by the project. *Andreas Oschlies*, Head of Research Unit Biogeochemical Modelling at the GEOMAR Helmholtz Centre for Ocean Research Kiel and member of the OceanNETs research consortium, then presented the concept of Ocean Alkalinity Enhancement / Ocean Alkalinization. He explained the natural CO<sub>2</sub> removal mechanism of chemical

weathering of rocks, and how this mechanism can increase alkalinity of ocean waters, allowing the ocean to store a higher amount of CO<sub>2</sub>. He further explained how such alkalinity enhancement could be achieved in the ocean by adding carbonate-containing minerals such as limestone or alkaline solutions via e.g., desalination plants to the ocean water, but also referred to challenges such as the high amount of necessary available resources, infrastructure and high cost currently associated with the NET.

*Lina Röschel*, Research Associate with the Task 2.2 team of the OceanNETs project at IASS, presented the main ocean governance challenges related to ocean-based NETs. She shortly introduced the current international regulatory framework around ocean-based NETs, including the London Convention and Protocol as well as the Convention on Biological Diversity, and argued that, while a framework is in place to govern NETs, it may not be fit to respond to open challenges. For one, the transboundary nature of the ocean was named as a challenge to comprehensive governance as potential effects of ocean-based NETs may travel from their initial entry point. Further, it was argued that the many unknowns and uncertainties surrounding the deployment of such technologies in the ocean as well as climate change need to be integrated into governance rather than causing “policy paralysis”. A holistic approach to governance may be needed to address the potential co-benefits and trade-offs associated with the deployment of ocean-based NETs to avoid that global policy goals are pitted against each other.

A short Q&A round provided participants with the opportunity to ask questions or make comments on the on the presentations before the participants were invited to move over and continue in two moderated breakout groups.

### **Summary of break-out group discussions**

Distributed across two breakout groups, participants were invited to jointly identify and discuss what governance of ocean-based NETs ought to entail to adhere to the targets set by the Paris Agreement, but further stay on path for additional global policy goals, such as SDG 14 “Life Below Water” set by the 2030 Agenda of the United Nations from an ocean point of view and relating to marine governance issues.

In the following, a summary of contributions and comments made during the discussion is provided. The parallel group discussions were organised along three overarching topics to which the facilitators provided a brief introduction before opening the discussion:

1. Stakeholders, roles and positions
2. Scope and scale of governance
3. Information and data

#### **1. Stakeholders, roles and positions**

This first round of the breakout group discussions considered three sub-questions:

- ▶ What are relevant stakeholders to ocean-based NET governance?
- ▶ What roles should stakeholders take within a governance framework for ocean-based NETs?
- ▶ What are options for comprehensive and fair decision-making?

In the breakout groups, the importance of international governance agencies and bodies already active in regulating ocean-based NETs, such as the International Maritime Organization (IMO) via the London Convention and London Protocol (LC/LP) and the Convention on Biological Diversity (CBD), including through secretariats and scientific advisory bodies, was stressed. The workshop raised the importance of political negotiations within these existing governance structures in order for the governance process for ocean-based NETs to move along and to address open issues. In addition to these highly relevant law-making bodies, as well as the supporting intergovernmental organizations and State parties, it was discussed that further stakeholders, e.g., from science, the general public and actors from the private sector ought to be included for comprehensive decision-making processes with regards to ocean-based NETs. Specifically, an intergenerational representation and an eco-centric perspective were addressed as important aspects for stakeholder identification and integration, and the inclusion of vulnerable groups and indigenous communities impacted by climate change. Moreover, it was also noted that marine life is often overlooked as a primary stakeholder to ocean-based NET governance, and the difficulty of appropriate representation of individual species and ecosystems, as well as their complex reactions to the technologies remains a challenge. Non-governmental organisations would need to take on the role as advocates for marine life and other underrepresented groups. It was noted that the land-ocean-connection plays a significant role for many of the proposed technologies also in terms of stakeholder engagement, e.g., inclusion of mining communities for ocean alkalinization, as well as to limit blind spots in ocean governance and beyond. It was further noted that the range of stakeholders to be included might differ between NET type and that NETs might require individualized approaches to governance, and be determined by scale, location, or type of technology and governance approach, among others.

There was also a discussion whether to draw the realm of actors to be involved wider and include all those (positively and negatively) affected by the deployment or limitation of the technologies. Further, it was questioned if to include, e.g., carbon accounting agencies who provide the incentives to deploy NETs in the ocean, or industrial stakeholders. It was noted that not all actors that are affected by or interested in NET deployment should necessarily become part of governance or decision-making processes as this could end in deadlock when individual interests drive the debates. Generally, stakeholder mapping could provide a suitable approach to identify relevant actors for NET governance arenas, as well as a mapping of suitable/relevant types of governance. Stakeholders purely affected by voluntary action, such as those acting under the objective of pursuing profit, could be excluded from decision-making processes. While such a wide stakeholder integration into governance processes may be challenging to put into practice, it provides a good starting point for good governance of ocean-based NETs, and it would provide a much greater challenge to change the governance system in place.

It was discussed that while the objective of wide participation in governance is ideally strived for, such ambitions may not be practical or easily implemented, as the success of stakeholder inclusion is not only met by good and inclusive policy processes but is also dependent on the willingness and availability for active participation of each stakeholder group. Capacity building and transparency in governance were identified as key components in governance of ocean-based NETs to ensure successful participation of different stakeholder groups in the future, especially in coastal zones, as well as including indigenous populations and communities with a high potential for being affected by the deployment of technologies, as well as those communities most likely impact by the effects of climate change. Further it was noted that understanding the perception of NETs by stakeholders is important, as is the way governance discussions are framed. Wording such as “dumping” induces specific conceptions of the topic. It was also noted that such inclusive stakeholder involvement would not have to be burdened only by government bodies, but mechanism could be put in place to involve

non-governmental or intergovernmental organisations to ensure stakeholder mobilisation and engagement.

## 2. Scope and scale of governance

The second topic aimed to consider how specific challenges identified should be dealt with and how governance could support overcoming these challenges rather than being stifled by them:

- ▶ How can transboundary effects of ocean-based NETs be approached to reflect “good governance”?
- ▶ What would “good governance” of ocean-based NETs need to entail to account for deep uncertainty?
- ▶ How can different policy goals be integrated? How to deal with possible trade-offs?

Potential transboundary effects of ocean-based NETs raised concerns over the monitoring systems in place for the ocean, which data is collected by which stakeholders, and the transparency of such data (also see section 3 below). It was raised that integrating procedural tools such as environmental impact assessments and a set of principles into decision-making processes would be key to incorporate consideration of transboundary effects into governance and avoid unilateral action by a single party. In this regard, the need to reflect different regimes for areas beyond national jurisdiction and within national jurisdiction was also mentioned as aspect for good ocean governance of ocean-based NETs. It was noted that an “Assessment Framework for Scientific Research” put in place by the Scientific Groups to the LC/LP provides criteria for an initial environmental assessment and monitoring for ocean fertilization and could be adapted for other ocean-based NETs.

Many uncertainties prevail in the deployment and governance of ocean-based NETs, so much so that it has been identified as a “wicked” challenge for which decision-making could never be truly risk free. At the same time, uncertainties should be further investigated to continue moving from “deep uncertainty” to a more “shallow uncertainty” that could be more easily managed by the governance frameworks in place. NETs may shift baseline scenarios for climate change in the coming years, which needs to be properly integrated into decision-making around these technologies. An adaptive approach to governance of ocean-based NETs that includes foresight and is thus more resilient against future unforeseen shocks to the system, e.g. wars, is the foundation for dealing with uncertainties. The precautionary principle was identified as the foundational guiding principle under uncertainty for decision-making related to ocean-based NETs, substantiated by environmental impact assessments and monitoring. The precautionary principle would perhaps have to be further developed and effectively implemented to avoid acting as a barrier, including to research, as uncovering of uncertainties is a part of science and innovation. It was agreed that a decision-making lock-in or “policy paralysis” due to prevailing uncertainties around the technologies would need to be avoided in order to overcome gaps in the governance framework. An added layer of complexities towards dealing with transboundary effects and uncertainty is provided by the fragmented nature of ocean governance framework, in which separate regimes would apply for different NET activities and impacts, and in conjunction with other governance frameworks, such as that for climate change.

It was determined that a more integrative approach between policy silos would benefit comprehensive governance of ocean-based NETs, and that a “sustainability lens” could provide a suitable framework for dealing with trade-offs. The governance of these technologies may add another sectoral layer to

ocean governance, as the technologies intend to support global climate ambitions, but may affect biodiversity and environmental goals as well as other maritime sectors. Deep sea-bed mining as emerging ocean governance challenge provides us with an example of an ocean activity governed by a single agency (the International Seabed Authority) that is lacking interlinkages with other sectoral governance. As ocean-based NETs collide ocean governance with climate governance (amongst other governance frameworks), an integrated approach of different governance regimes working together on this topic may be beneficial. It was further emphasized that there is an urgent need for a framework to govern NETs in the ocean, with robust processes and globally agreed principles, and guidance for good practices and management of NET deployment. It might not necessarily require a legally binding framework, but procedural tools alone might not be sufficient. The question was raised whether a more comprehensive approach is required, and recourse to procedures and transparency, to achieve “good governance”, while other voices raised concern that adding further complexity to governance can also be risky.

### 3. Information and data

The third sub-topic discussed looked at information and data requirements to enable and support good governance of ocean-based NETs:

- ▶ What information is needed for comprehensive decision making?
- ▶ How should information be integrated into decision-making?
- ▶ Should there be rules for information provision, access and sharing, monitoring etc.?

To make sustainable and inclusive decisions for ocean-based NETs, it was determined that a wide range of environmental, socio-cultural and socio-economic data, including information on their interlinkages and compounding effects, are needed. This data would need to be of good quality, transparently available in an understandable format that is easy-to-use for different target groups, and easily accessible for governance, science and society. It should also be available in a unified format that is comparable to other available ocean data to better close knowledge gaps.

Sharing of data was mentioned as a key component to good governance of ocean-based NETs, as data from coastal areas often lacks such availability. This was particularly relevant since NET deployment would primarily take place in along coastlines. It was noted that private industry gaining potential profits from deployment of ocean-based NETs should not be in charge of producing their own monitoring data, but that governments or independent oversight via intergovernmental agencies or separate private companies are crucial to ensure good provision of information and data. Regulations should in addition be put in place to determine which data is needed at what time scales, etc., to provide a structured and easily verifiable approach to data collection. Further, it was suggested that in addition to providing information on actions taken to mitigate climate change, it would be equally important to compile information on consequences of inaction and by that provide assessments of different options to support decision-making in the context of uncertainty.

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