Commissioned by

HIGH LEVEL PANEL *for*
A SUSTAINABLE
OCEAN ECONOMY

BLUE PAPER

Summary for Decision-Makers

What Role for Ocean Renewable Energy and Deep-Seabed Minerals in a Sustainable Future?

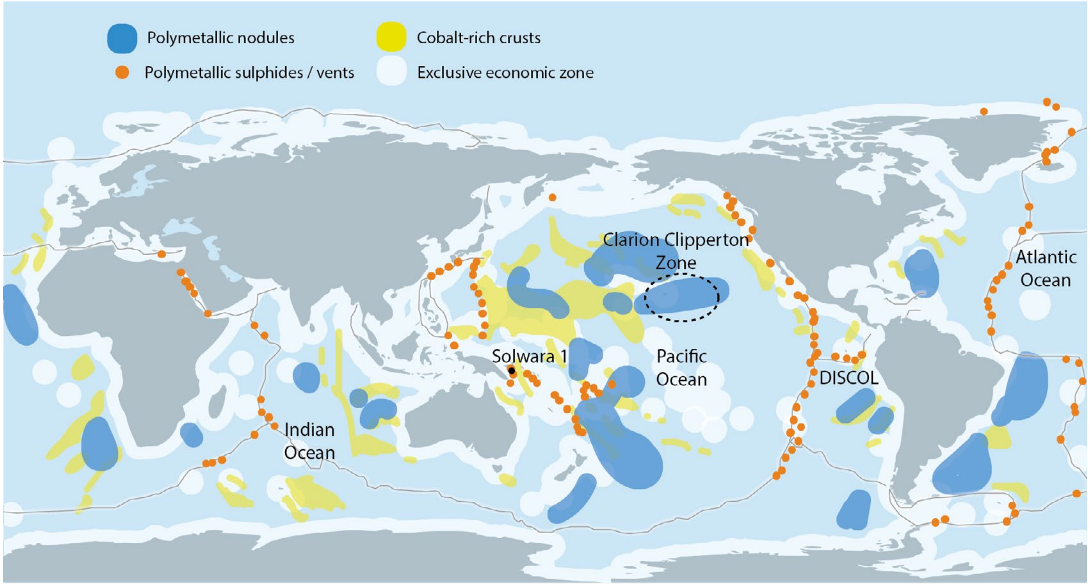
Science tells us that we must move rapidly towards net zero greenhouse gas emissions if we are to achieve the goals of the Paris Agreement and limit the global average temperature rise to 1.5°C above pre-industrial levels. Achieving this will require the rapid transformation of our energy systems. In addition to expanding land-based renewable energy, the ocean offers significant potential for supporting this effort. However, all new technologies must be implemented in a sustainable way to avoid unintended consequences that could undermine other aspects of ocean health.

An analysis published in 2019 indicated that ocean-based renewable energy, from sources such as fixed and floating wind, tidal and current, could deliver up to 5.4 percent of the annual emissions reductions needed by 2050 to limit the temperature increase to the 1.5°C target set by the Paris Agreement.[1] Unlike energy production from fossil fuels, the different technologies needed to generate renewable energy onshore and offshore, such as solar panels and wind turbines, are heavily reliant on various metals and rare earth elements (REEs).[2]

The deep seabed has revealed itself as an increasingly attractive prospect for mining operations due to its high mineral resource potential. The primary metals and minerals of interest on the deep seabed include copper, cobalt, nickel, zinc, silver, gold, lithium, REEs and phosphorites. Many of these metals are abundant in polymetallic nodules on abyssal plains (at a depth of 3,000–6,500 metres (m)), on cobalt-rich ferromanganese crusts which occur on seamounts (at a depth of 800–2,500 m), and in polymetallic sulphides at hydrothermal vents near mid-ocean ridges and in back-arc basins (at a depth of 1,000–4,000 m) (Figure 1). These deposits often occur in areas beyond national jurisdiction, which are managed by the International Seabed Authority under the UN Convention on the Law of the Sea.

The mining of these resources in the deep seabed raises environmental, legal and governance challenges, as well as possible conflicts with the United Nations Sustainable Development Goals. Greater knowledge of the environmental impacts, as well as the ability to

Figure 1. Distribution of Polymetallic Nodules, Polymetallic Sulphides and Cobalt-Rich Crust Resources in the Deep Sea



Note: The white area around Antarctica is not an EEZ, but reflects management and conservation under the Antarctic Treaty.

Source: Miller et al 2018; Hein et al. 2013.

mitigate these to acceptable levels, is required before there can be confidence that engaging in industrial-scale deep-seabed mining would achieve a global net benefit.

A new paper,[3] commissioned by the High Level Panel for a Sustainable Ocean Economy, provides an analysis of possible tensions between the low-carbon future energy system needed to combat climate change, and the resource and environmental implications relating to the increased metal demand seen alongside an increased deployment of renewable energy technologies and electrification of vehicles. In doing so, the paper proposes a pathway seeking to achieve deployment of renewable energy in a sustainable manner – one that considers not only the need for rapid decarbonisation, but also the environmental and resource implications associated with it, including related seabed-mining issues.

In analysing ocean-based renewable energy options, the paper finds that the development of these technologies is currently too slow for a timely phase-out of fossil fuels. This is evidenced by a lack of knowledge on the environmental impacts of these technologies and on the costs and materials required to deploy ocean technologies on a large scale, particularly in the case of less mature technologies, such as tidal, wave, thermal, salinity, current, floating solar and high-altitude wind.

As a more mature technology, offshore wind is known to rely on REEs for its direct-drive permanent magnet generators. This appears to be the biggest potential challenge when it comes to supply of minerals. However, REEs are not specifically targeted in deep-sea mining, and the need for REEs is expected to diminish as the industry improves material efficiency and adopts REE-free turbine designs – for example, through transitions to even larger turbines using superconductor generators which are less reliant on REEs.[4]

Since most ocean-based renewable energy technologies are still in early phases of development, few studies have been completed on what materials will be needed to scale up the use of these technologies. If these technologies have similar metal requirements to modern offshore wind turbines, which is likely, implementation will increase the demand for many metals and REEs.

Deep-seabed mining as a proposed source for many of the metals needed for renewable energy technologies and electrification of transport is still fraught with uncertainties, especially when considering the current state of knowledge, arguments for and against, and unknowns around the nature, severity, implications and mitigation of environmental impacts. The paper also explores other challenges associated with seeking to govern a new extractive industry through a multilateral process, and in trying to achieve equitable and global benefit from exploitation of resources legally identified as the 'common heritage of mankind. The paper highlights a need to improve current knowledge and management capabilities in order for the sector to proceed responsibly.

The paper considers that reducing metal demand may be achieved with research into alternative technologies that reduce or eliminate the use of critical metals under greatest resource pressure. Further investment in the concept of a circular economy, which acts through improved product design, reuse, recycling, reclassification of materials and use of renewable energy for production would advance this option.

The paper identifies several opportunities for action to ensure that the ocean stays healthy and resilient for future generations and that ocean-based renewable energy is harvested in a sustainable manner. Opportunities for action are paired with the underlying challenges identified by the paper.

Opportunities for Action

CHALLENGES	OPPORTUNITIES FOR ACTION
Development of ocean-based renewable energy is too slow for timely phase-out of fossil fuels.	• Strengthen R&D and demonstration programmes and financing, taxation and legal regimes. • Strengthen R&D on environmental impacts of ocean-based renewable energy and establish baselines for environmental impact assessments and marine spatial planning. • Reduce energy demand by making energy end-use more efficient in all sectors of society.
Growing global demand for rare metals and minerals.	• Engage in independent research and long-term planning to facilitate a circular economy for targeted metals and minerals. • Focus attention on Life Cycle Sustainability Analysis and develop alternative methods to address the metal demand. • Strengthen R&D and economic incentives to favour a less mineral-intensive renewable energy system.
Knowledge gaps in understanding how deep-ocean ecosystems will respond to mining disturbance.	• Slow the process of transitioning from seabed mineral exploration to exploitation to allow time for more research and regulation development. • Create an international research agenda through the UN Decade for Science for Sustainable Development to expand research and synthesise high-quality scientific data.
Conflict between a duty to protect the marine environment, and a call to mine the deep seabed for metals	• Enable an expert and independent environmental and scientific committee to handle the environmental regulations and decision-making within the International Seabed Authority (ISA). • Declare and enforce a network of large, biologically representative, fully protected no-mining zones.
Gaining participation of all relevant stakeholders in decision-making.	• Cooperate to enhance societal awareness of the choices associated with deep-seabed mining. • Maximise opportunities for public and expert consultation. • Facilitate the attendance of all stakeholders to the ISA and intergovernmental meetings.

The development of a sustainable global energy system is intimately linked to both scaling up renewable energy and finding a way to use critical metals and minerals in a more sustainable way. Investing and adopting the proposed actions will allow for an increased contribution of ocean renewable energy for climate change mitigation while simultaneously liberating the pressures put on ocean ecosystems and legal frameworks for deep-ocean ecosystems by decreasing the need for metals and minerals over time.

The High Level Panel for a Sustainable Ocean Economy

The High Level Panel for a Sustainable Ocean Economy (Ocean Panel) is a unique initiative of 14 serving world leaders who are building momentum towards a sustainable ocean economy, where effective protection, sustainable production and equitable prosperity go hand in hand.

Co-chaired by Norway and Palau, the Ocean Panel comprises members from Australia, Canada, Chile, Fiji, Ghana, Indonesia, Jamaica, Japan, Kenya, Mexico, Namibia, Norway, Palau and Portugal and is supported by the UN Secretary-General's Special Envoy for the Ocean.

The Ocean Panel gathers input from a wide array of stakeholders, including an Expert Group and an Advisory Network. The Secretariat, based at World Resources Institute, assists with analytical work, communications and stakeholder engagement.

The Blue Paper that this brief summarises is an independent input to the Ocean Panel process and does not necessarily represent the thinking of the Ocean Panel, Sherpas or Secretariat.

For more information, including the full report, visit **www.oceanpanel.org**

Endnotes

1 Hoegh-Guldberg, O. et al. 2019. *The Ocean as a Solution to Climate Change: Five Opportunities for Action*. Washington, DC: World Resources Institute. http://www.oceanpanel.org/climate.

2 IRP (International Resource Panel). 2019. *Mineral Resource Governance in the 21st Century: Gearing Extractive Industries Towards Sustainable Development*, edited by Elias T. Ayuk, Antonio M. Pedro, Paul Ekins, Bruno Oberle, Julius Gatune, Ben Milligan. Nairobi: United Nations Environment Programme. https://www.resourcepanel.org/reports/mineral-resource-governance-21st-century. Giurco, Damien, Elsa Dominish, Nick Florin, Takuma Watari and Benjamin McLellan. 2019. “Requirements for Minerals and Metals for 100% Renewable Scenarios.” In *Achieving the Paris Climate Agreement Goals*, edited by S. Teske, 437–57. https://doi.org/10.1007/978-3-030-05843-2_11.

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4 Pavel, Claudiu C., Roberto Lacal-Arántegui, Alain Marmier, Doris Schüler, Evangelos Tzimas, Matthias Buchert, Wolfgang Jenseit and Darina Blagoeva. 2017. “Substitution strategies for reducing the use of rare earths in wind turbines.” *Resources Policy* 52: 349–57. http://dx.doi.org/10.1016/j.resourpol.2017.04.010.

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