Summary of the Institute for Sustainable Futures report:
Renewable Energy and Deep Sea Mining:
supply, demand and scenarios

Introduction

The first commercial exploitation of minerals from the deep sea is likely to begin in 2019. Mining companies are exploring commercial deep-sea mining opportunities in the waters of a number of countries as well as in the deep-ocean beyond any country's national jurisdiction.

There are three types of deep seabed mining planned:

- Polymetallic nodules on the deep ocean floor
- Cobalt crusts on seamounts
- Polymetallic sulphides formed around hydrothermal vents

A major impetus for exploiting minerals in the deep sea has been increasing global demand for copper, cobalt, nickel, lithium, silver and rare earth and specialty metals. This is partly being driven by the growth of renewable energy technologies. These types of metals are used in rechargeable batteries, solar photovoltaic generators and wind power plants.

However, an authoritative report from the Institute for Sustainable Futures, University of Technology Sydney, has concluded that even under the most ambitious scenario – a transition to a 100% renewable energy economy on a global basis by 2050 - demand for the metals required can be met without mining the deep-sea.

The report, *Renewable Energy and Deep-Sea Mining: Supply, Demand and Scenarios*, published in July 2016, found that projected demand for silver and lithium to 2050 will take up just 35% of known terrestrial resources, and demand for other metals – copper, cobalt, nickel, specialty and rare earth metals – represents less than 5% of existing resources. Further, although production of silver, lithium and rare earth metals will need to increase, other strategies such as increased recycling have an important contribution to make.

The report concludes: "Even with the projected very high demand growth rates under the most ambitious energy scenarios, the projected increase in cumulative demand – all within the range of known terrestrial resources – does not require deep-sea mining activity."

This synthesis provides an overview of the report and some of its key findings.

1. About the report

The Institute for Sustainable Futures is a research and consultancy body established by the University of Technology Sydney, Australia in 1996. It works with industry, government and other parties to find strategic ways forward to a sustainable future. (For more information: ww.uts.edu.au)

The ISF report on renewable energy and deep seabed mining was funded by the J.M.Kaplan Fund, Oceans 5 and Synchronicity Earth and the Deep Sea Conservation Coalition.

Using modelling techniques and various scenarios, the report examines future demand for copper, cobalt, nickel, lithium, silver tellurium, and rare earth metals. in the context of a transition to a low-carbon energy economy, where renewable energy technologies – such as solar panels and wind turbines – are giving rise to a new demand for these metals.

The report examines the availability of these metals from existing terrestrial resources, and asks whether it is necessary to exploit deep-sea resources for the transition to renewable energy to occur.

2. The report's significance

The report is significant because corporate and other proponents of deep seabed mining use the argument that it is necessary to allow the growth of clean technologies. The ISF found that this is not the case.

3. The scenarios and terms used

The ISF examined how demand for metals might look under three scenarios:

- A reference scenario (REF), based on existing international energy and environmental policies;
- An energy revolution scenario (ER), which assumes the target of reducing worldwide carbon dioxide emissions to 4 giga-tonnes per year by 2050 and phasing out nuclear energy;
- An advanced energy revolution scenario (ADV ER), which assumes much stronger efforts to transform the energy systems of all regions in the world towards a 100% renewable energy supply.

The ISF examined demand in relation to both existing terrestrial mineral resources and reserves.

The terms “resources” and “reserves” have important differences of meaning. Reserves are a sub-set of resources. Terrestrial metal *resources* are the total amount of metallic mineral that is believed to exist in terrestrial areas of the planet. Terrestrial metal *reserves* are the amount of this mineral that can be economically extracted.

Over time, resources in particular locations can be reclassified as reserves – for example if higher prices and strong demand justify the mining of lower grade deposits, or if new technologies reduce the costs of extraction.

4. Findings about known terrestrial mineral resources

The ISF study finds that under the most ambitious scenario – where the world moves to 100% renewable energy technologies by 2015 (ADV ER) – the cumulative demand for silver and lithium will still be less than 35% of known terrestrial resources. Demand for all the other metals will be less than 5% of current resources under all scenarios.

5. Findings about known terrestrial mineral reserves

The ISF study finds that the demand for silver and lithium could possibly exceed current reserves. Under the scenario where the world moves to renewable energy technologies with most commitment (ADV ER) the cumulative demand for silver and lithium will be 99% and 94% of known terrestrial resources, respectively.

However, this is the most ambitious scenario for a move to renewable energy. And the report points out that increasing recycling could ease pressure on mining production and the development of new battery chemistries would also change the demand profile.

6. Findings about trends in renewable energy technologies

Renewable energy is any form of energy from solar, geophysical or biological sources that is replenished by natural processes at a rate that equals or exceeds its rate of use.

The report says that at the end of 2014, about 28% of global electricity generation capacity was renewable – enough to meet more than 20% of the global power demand. Total growth in renewable electricity production between 2007-2012 (5.9 %) was more than double the rate of increase in global demand (average 2.7 %), indicating a trend towards displacing fossil energy generation.

Market developments and projections suggest that solar photovoltaic generators, wind, hydro and concentrated solar power plants are the main renewable energy technologies, and will remain dominant to 2050.

7. Findings about current and future production rates

The ISF points out that increasing mining production output per year is more important than finding new resources.

The projected overall cumulative demand for the rare earth metals neodymium and dysprosium to 2050, for example, represents 11% and 7.5 % of the known reserves. So there is substantial scope for increasing production rates from terrestrial reserves.

The report also notes that current recycling rates of high-demand metals such as silver, lithium, neodymium and dysprosium are currently less than 1% and that an increase in recycling will improve production rates and reduce incentives to mine new sources of supply.

8. Findings about recycling renewable energy technologies

The report finds that:

- Increasing recycling to offset demand will be increasingly important, particularly in the case of lithium (batteries), silver (solar photovoltaic generators and concentrated solar power plants) and tellurium (cadmium telluride solar cells).
- Recycling is generally less carbon-intensive than primary production.
- It is technically possible to recycle 80-95% of the bulk materials used in wind turbines.
- New European recycling regulations are likely to increase recycling of photovoltaic generators, and recent reports suggest recycling rates of 80% are achievable.
- There is scope to develop recycling technologies to separate silver and copper from glass in concentrated solar power plants.
- Recycling of lithium batteries is currently very low, and needs to increase to 40% by 2050.
- Further work is needed to better understand the potential for recycling to offset primary production.

9. Conclusions about the need for deep seabed mining

The ISF concludes that:

- A transition towards a 100% renewable energy supply can take place without deep seabed mining.
- Even if demand grows steeply, under the most ambitious renewable energy scenarios, it can be met from known terrestrial resources and improved recycling of metals.
- Deep seabed mining will not be required to meet demand.

10. Key quotations from the report's conclusions

No need for deep-sea mining
"A transition towards a 100% renewable energy supply can take place without deep-sea mining. Metal demand associated with the dominant renewable technologies evaluated in this report, even assuming very aggressive growth rates under the most ambitious future energy scenarios, do not require deep-sea mining activity."

Demand for some metals needs to be addressed
"The significant increase in production demands for neodymium and dysprosium, and the projected volumes of lithium and silver relative to current reserves, suggests these metals require special attention."

Increasing recycling is important
"Increasing recycling rates is a very important part of the solution to securing the supply of metals for renewable power generation technologies and electric vehicle components."
"Future recycling efficiencies will ultimately be impacted by technology design, including 'design for recycling', and future investment in efficient collection and sorting systems."

Towards a sustainable energy system
"To achieve a truly sustainable energy system, both in terms of emission mitigation and responsible supply of resources, we need to focus on improving material productivity in parallel to the renewable energy market expansion."

Prepared by Deep Sea Conservation Coalition 2017