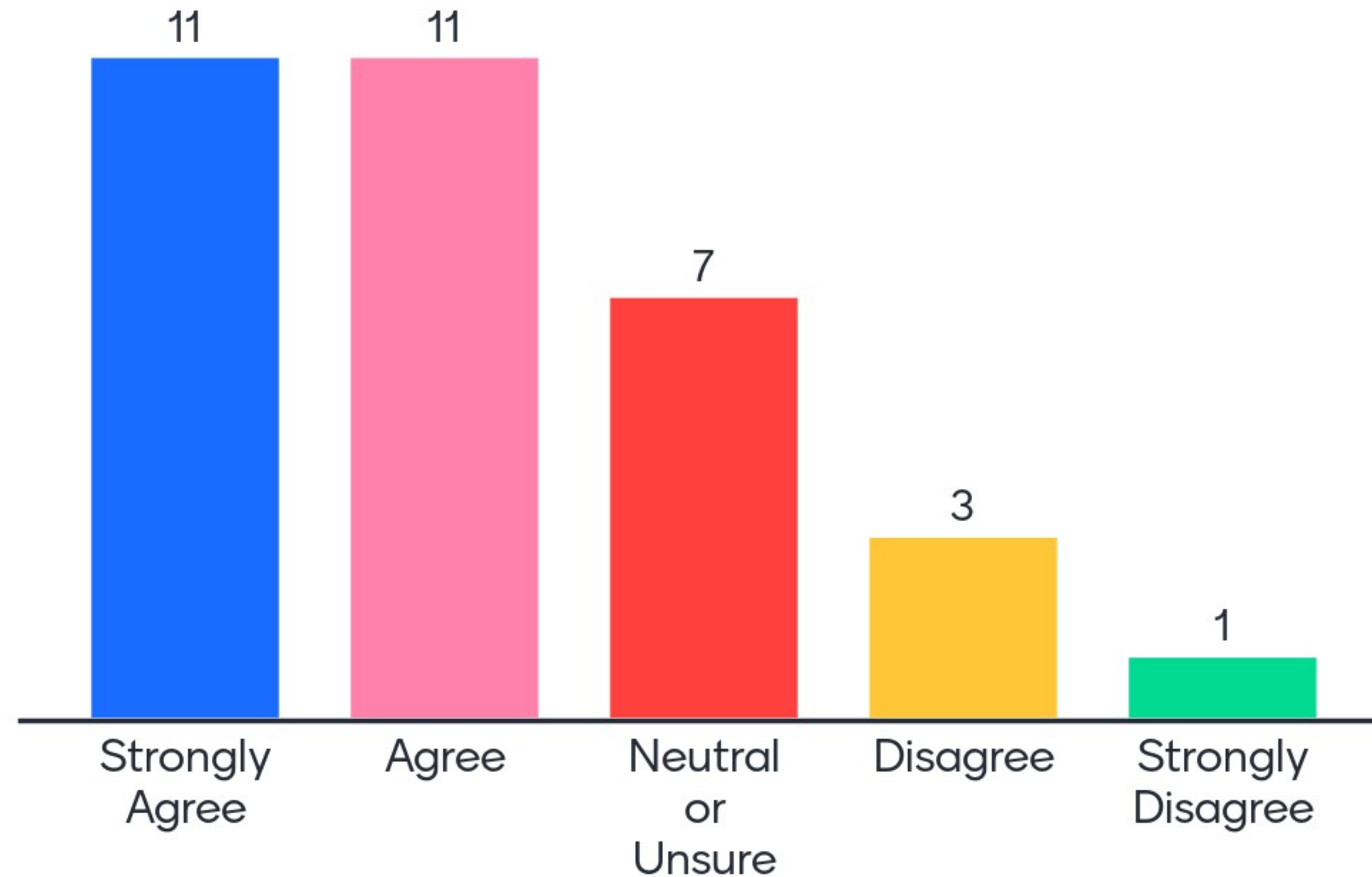
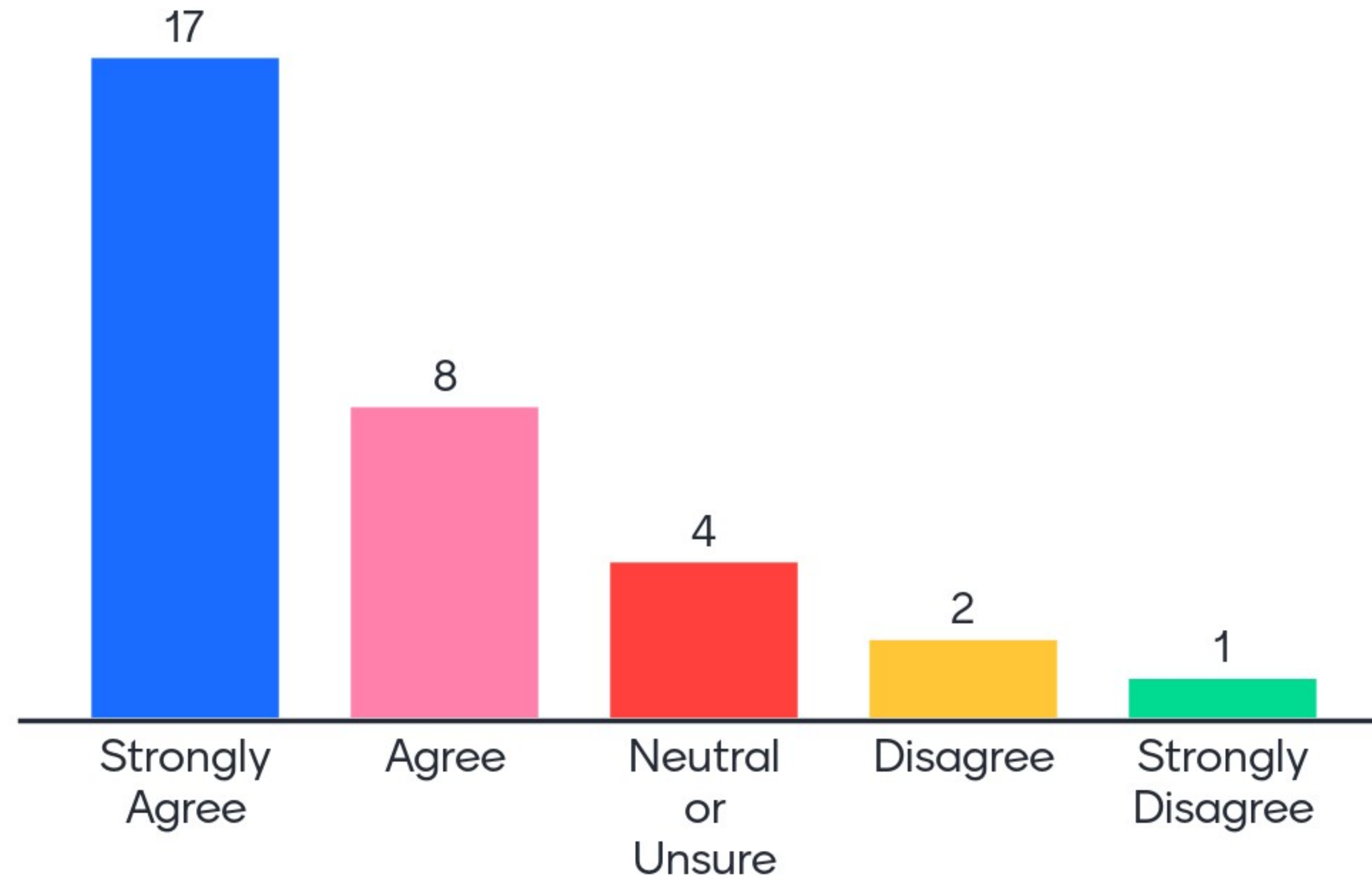


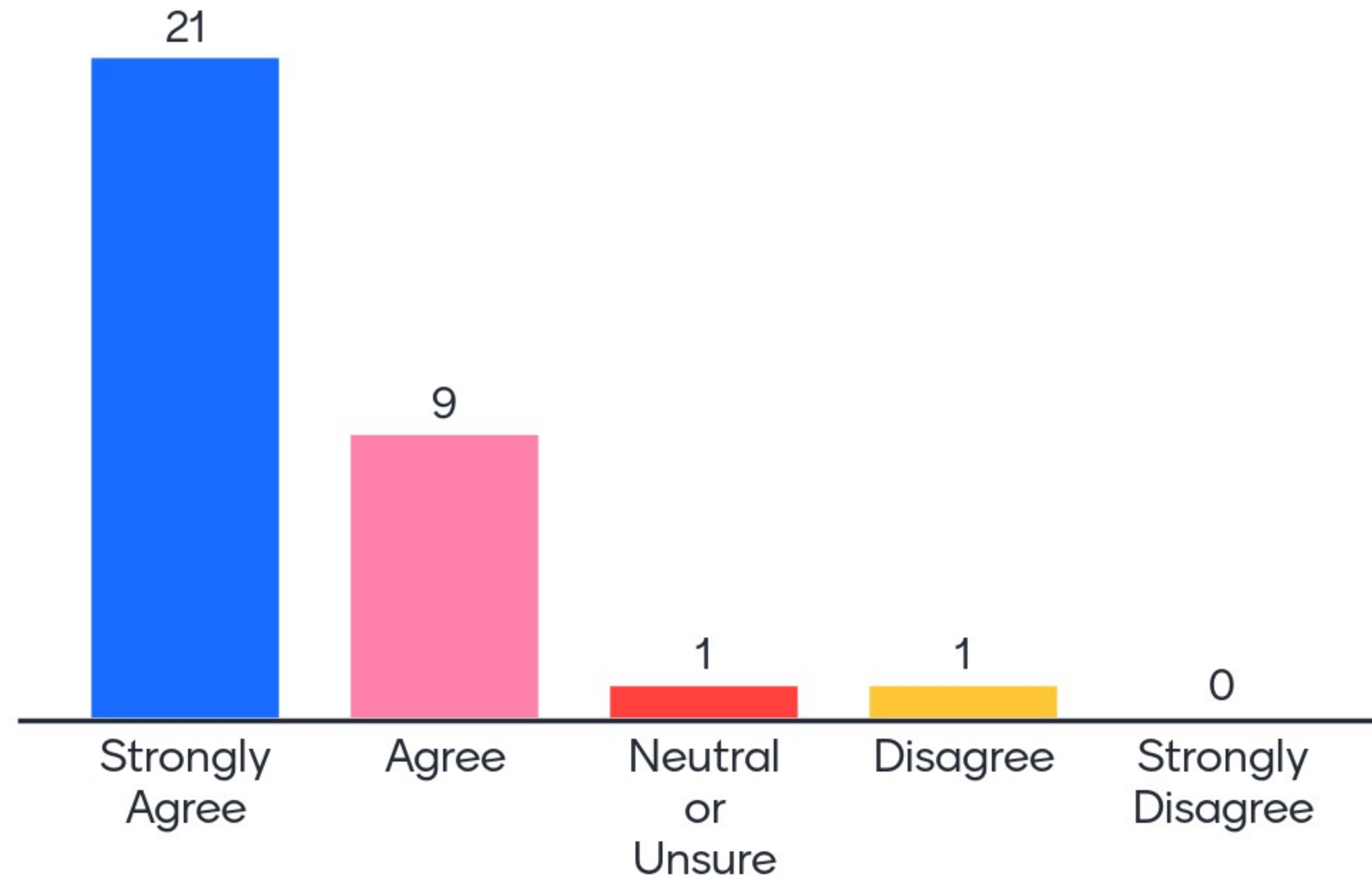
If offshore wind is considered harmful to marine ecosystems, then the total development (in GW) may be significantly limited because of these effects.



Offshore wind hardscapes (e.g. surfaces of support structures) can be created that provide valuable ecosystem services.



Field studies are needed to determine how to design, install, and maintain support structures so that they provide valuable ecosystem services.



What should be done to advance the design and use of nature-inclusive offshore wind structures? What are the roles for different stakeholders?

Define objectives for nature-inclusive design.

no expert here - nut seems to be the foundations will be in deeper water and not so amendable to the marine environment. I would only guess perhaps reefs to create shallower water may help. The developers and state likely need to pay the cost

By monitoring the performance of the existing structures and also by integrating a nature-based design to offshore wind infrastructure. Project development agencies find suitable offshore areas, issue leases, request and review a site assessment.

Governments should fund projects to better understand the impact of design selections on marine ecosystems.

Consideration of impacts by companies

Socio economic analysis informed by experimental field based marine ecology studies that compare negative impacts of offshore wind installation to the environmental impact of generating equivalent amounts of energy using fossil fuels.

Government regulations to force a defined percentage of project cost to such structures. Maybe bound to PTC or feed-in tariffs as an incentive.

Should be a focus for reserach funding from NOAA fisheries; Need to look at regional differences; incorporate known, ongoing changes due to climate change into impact analysis of various design/material options;

science-based, hypothesis-driven field studies to determine the effect of nature inclusive design on benthic functioning (habitat provision [habitat use], nutrient cycling, carbon cycling, invasives)

What should be done to advance the design and use of nature-inclusive offshore wind structures? What are the roles for different stakeholders?

Nature-based design; Pilot studies; Field experiments;
Communication and outreach

Create consensus on priority research and sequence of steps needed.

Joint development/testing with industry engineers to build confidence in use of NID options in wind farm designs

Developing low-noise installation method. develop ocean creature friendly coating. Total dissemination of materials after end of operation.

Trial as early as possible Nature Inclusive Design options looking at the Netherlands for examples of what they have done and what companies are leading the field. Used shared learnings from academia and industry. Engage fishing industry early.

1.Design fatigue life shall be at least two times of the intend design life. 2.Shall incorporate easy accessibility design for safe inspection, maintenance and repair. 3.Do-it-right-the-First-time corrosion protection during Newbuilding. design.

4. Research on no-water inside Monopile wind turbine design.

Long-term monitoring and scalable pilots should be performed in OWPs for the scientific community, government and industry to act upon. In addition, the government has an essential role in determining the overall vision and planning for OWP locations

Draw on lessons from artificial reefs; test designs in the field and using computer simulation; obtain broad stakeholder input on exploitation of surface production

What should be done to advance the design and use of nature-inclusive offshore wind structures? What are the roles for different stakeholders?

Supports from regulatory bodies are needed.

Couple hydrodynamic, chemical and ecological studies at wind farms.

This discussion needs to mesh with the OW / Fisheries mitigation efforts that are in process for BOEM to develop guidelines. If structures are going to be left behind, it will not matter and BOEM should consider marine activity restrictions.

Need field experimentation with good controls on specific measurements of the contribution of new structures. Must go beyond biodiversity to examine function of habitat and effects on larger ecosystem

Determine what is limiting use of nature-based solutions - regulations, cost, risks?

If there is consistent motion of the water inside, it should be considered to harvest some of that energy (if the motion needs to be damped and the internal mixing depressed). The tides and waves are present even when there may be low winds.

Understand the habitat requirements of sensitive and vulnerable species in a region that could be well served by appropriately designed structures. Ensure that all relevant permitting agencies are part of the conversation.

it needs to be clear what happens at end of life for these structures. Stakeholders need a clear view of decommissioning v. nature-inclusive designs. the issue of harvest obstruction = not covered. regime shift in speciation = only mentioned.

Decommissioning is a serious concern if we are starting down this path. If we are going to leave obstructions in the water, then BOEM and NOAA need to work with fishermen to adapt their harvest methods which also require NEPA review. Or compensate.

What should be done to advance the design and use of nature-inclusive offshore wind structures? What are the roles for different stakeholders?

The issue of speciation shift needs to be seriously considered. With farms together, this will be a regional and soon a coast scale issue. Will raising hard benthic habit change species that can be harvested and marketed by exiting stakeholders.

It is reported that land locations are having difficulty renewing the site use for wind after decommissioning. A forward looking analysis of spatial planning needs to be made if we plan to sustain offshore wind beyond 35 years. Reef building blocks a

Can a material be designed for piles and underwater foundations that actually gets stronger with marine colonization? Doubtful due to the strength needed v. non-uniform colonization patterns, but this was a thought that came up in this meeting.

What should be done to enable the design of ecosystem-friendly offshore wind. Who should fund and do this?

Multiple open-ended responses are welcome.

test different materials and geometries in wind energy area

governments should pay for this

work should be done jointly by industry, scientists, and impacted communities

Public-private partnerships to develop designs and fund testing

Federal, state and local governments can greatly facilitate a move to more ecosystem-friendly offshore wind by funding testing or providing incentives to industry

Joined up thinking from the industry and buy-in from developers (owners). Another potential way is to get regulators or Permitting bodies to include a clause regarding this so that this can trickle into the design.

Owners project teams are usually contractors trying to deliver project. However, if this is included in their KPI, instead of pure economics and schedule, then we can slowly change that mindset

A number of owners already have this in place, with innovation budget to assess and potentially install the foundations which may be more beneficial to ecosystems.

-Investment in large-scale in situ studies of habitat enhancements role from moorings-Consideration of standardisation for ecosystem-friendly offshore infrastructure -Support for research into population connectivity created by offshore network

What should be done to enable the design of ecosystem-friendly offshore wind. Who should fund and do this?

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Field studies should be integrated part of projects and funded by project developers in collaboration with government and research institutes

JIP organizations can do the research and pilot studies, gov + developers (direct permitting and design responsibility)

Test field deployments. R&D on best substrates.
Governmental agencies

Survey existing structures. Publicly funded government research.

A clear regulatory framework with an informed and comprehensive vision for the future (desired) situation.

Should include consideration of commercially important species-wild harvest and aquaculture

Teaming of applied marine ecologists with designer engineers owner etc to develop improved design

Governments and developers should fund and develop this jointly. Therefore, co-creation.

Design a method of a cheap easy made module that can be cheaply applied. In the netherlands we need substantial surfaces if we take pot fisheries as a target. More hard substrate leads to more primary production and more productive system. So OWFs

What should be done to enable the design of ecosystem-friendly offshore wind. Who should fund and do this?

Multiple open-ended responses are welcome.

Include applied marine ecologist in the design teams to look for methods to enhance ecosystem effect

cheap as possible, easy to make, easy to remove

The OWF should be made responsible by the government, connected to the licensing

Widespread observations and studies on habitat development, fisheries, and water quality in constructed wind plants.

In the Netherlands the anticourt level improvement does not really contribute at system level. So how to colonize the open between the monopiles. OWFs should fund and government. Research institutes do it.

repetition of question

OWF have large impact on sea mammals and birds. In addition it will take away energy from the system reducing PP. There should be a very large scale vision on the North Sea ecosystem level and different scenarios, in 30 y conversion all solar

repetition of question

Vision on large scale impacts Make OWFs responsible in enabling the final choice Create a large fund paid by mostly OWF and Government

What should be done to enable the design of ecosystem-friendly offshore wind. Who should fund and do this? Multiple open-ended responses are welcome.

repetition of question

repetition of question

Government

Public -private funding: OSW developers, federal ocean management agencier

see earlier

See earlier: vision on impact, choose scenario, OWFs should pay (with government) Have a research vision and start