ODOE's Objective:
To gather and synthesize the range of perspectives on the benefits and challenges of integrating up to 3 GW of floating offshore wind (FOSW) energy into Oregon's electric grid by 2030 as directed in HB 3375.

Background
Oregon House Bill 3375 (2021) requires the Department to conduct a literature review, gather stakeholder input, and submit a report to the legislature on the benefits and challenges of developing three gigawatts of FOSW off Oregon's coast by 2030.

A draft literature review report on ODOE's FOSW Study website serves as a response to the **first core component** of this legislatively directed study. Studies employing quantitative modeling efforts, while valuable, can fall short in comprehensively addressing important qualitative issues – both positive and negative – implicated by potential FOSW deployment. We have structured the **second core component** of this process – the focus on this document – to gather input to focus more on these types of qualitative issues. The draft literature review helped to shape and inform the creation of prompting questions listed on the following pages and to which we are asking you to provide feedback in **ODOE's Comment Portal**.

The **third core component** of this process will involve convening public meetings to share information from the literature review and comments to gather additional feedback from stakeholders. Importantly, ODOE does not intend for the summary of the key topics identified from its literature review or themes from stakeholder feedback to convey an endorsement of findings by the Oregon Department of Energy or the State of Oregon – we will make this clear in the **fourth core component** of this process – the final report to the Legislature that we submit by September 15, 2022.

Instructions for Responding to Prompting Questions:
If you are aware of compelling analysis or topics that are in scope but missing in the draft literature review report on ODOE's FOSW Study website that are described in another study, report, article, or other piece of literature that was not included in the literature review, please incorporate those suggestions into the written comments you provide through the online Comment Portal. It is important to this process that we capture the variety of viewpoints and perspectives that Oregon stakeholders believe are important and relevant to the prospect of FOSW off Oregon's coast.

To support your participation in responding to questions, it may be useful to refer to background information available on ODOE's FOSW Study website, which covers information about how floating offshore wind technology differs from bottom-fixed offshore wind, typical costs, comparisons to other renewable energy technologies, infrastructure needs, and more. On the pages ahead, you will find questions categorized based on five broad topics and several sub-topics. Your answers to these questions will play a critical role in helping to inform the state with a better understanding of stakeholder perspectives on key issues relating to the potential for integrating large-scale deployments of FOSW into Oregon's electric grid. Given the technical nature of these questions and that some stakeholders have more data and analysis to address

some of these questions than others, it is not required to answer every question - Please provide feedback on as many questions as you can.

- **Foundational Questions**
  - Achieving 100% Clean Energy Targets
  - Economic Development
  - Equity
  - Reliability & Resilience
- **Technology Questions**
  - FOSW Turbines
  - FOSW Platforms
- **Infrastructure Questions**
  - Port Infrastructure
  - Transmission Infrastructure
- **Energy Market & RTO Questions**
  - Investors/Purchasers (Offtakers)
  - Regional Transmission Organization (RTO)
- **Siting and Permitting Questions**
- **Miscellaneous Questions**

When responding to questions, and to the extent possible, please include citations in support of feedback that could be beneficial for the Department to consider in its drafting of the report to the Legislature that will provide a summary of key findings related to the benefits and challenges of FOSW, including opportunities for future study and engagement.

Foundational Questions

A. **Achieving 100% Clean Energy Targets**: Oregon has a target for 100% clean electricity by 2040. In addition, Washington, California, and Idaho's largest electric utilities all have targets for 100% clean electricity by 2045; and Nevada has a target for 100% clean electricity by 2050. Many other western states also have clean energy targets to different degrees and on various timescales. Technical analyses have identified that FOSW has relatively high capacity factors; FOSW can be complementary to loads, solar resources, and onshore wind resources in the PNW; and FOSW can benefit late summer hydro constraints.

(1) **FOSW Contribution to 100% Clean:** How do you expect FOSW to contribute to achieving a 100% clean electricity future? Do you expect FOSW to serve a critical role in supplying Oregon and/or other states with the clean electricity needed to achieve policy goals – particularly at times when other generation resources may be limited (e.g. land-based solar and wind), or times that could optimize the use of other regional supply-side resources (e.g. hydro, transmission, possibly others)? Please cite technical analyses, where available.

B. **<u>Economic Development</u>:** Studies have indicated the potential for economic development benefits from offshore wind development, including from: work required to construct and operate FOSW projects; work tied to supply chains for FOSW components; work tied to upgrading onshore infrastructure – such as ports, transmission lines and substations; and indirect economic benefits beyond the FOSW supply chain and related infrastructure upgrades – to sectors such as housing, hospitality, recreation, and others.

(2) **Overall Benefits:** How would the specific location(s) of a FOSW project(s) impact how these potential economic development benefits accrue to different communities and states?

(3) **Location of Benefits:** Are these economic development benefits expected to be primarily confined to the specific areas surrounding the port from which FOSW projects would be deployed?

(4) **Net Benefits:** Are there potential tradeoffs between new economic development benefits tied to the deployment of FOSW projects and existing economic benefits (e.g. fishing, shipping, recreation, etc.) tied to port economies currently? How could FOSW deployment lead to net positive economic benefits for Oregon?

C. **<u>Equity:</u>** A study specific to the effects of FOSW deployment for California indicated that direct job gains would likely be in areas of the state that are economically lagging, and therefore FOSW could help promote income equity. In addition, the study indicated FOSW could contribute towards environmental equity by displacing fossil fuel generation located in areas with "disadvantaged populations."

(5) **Economic Equity for Coastal and Broader Oregon:** How do you see FOSW as an opportunity to promote income equity in and around communities along the Oregon coast? How could FOSW help promote income equity in other economically lagging communities across Oregon?

(6) **Oregon Environmental Justice and Equity:** How do you see FOSW as an opportunity to promote environmental equity in and around communities across Oregon?

D. **<u>Reliability & Resilience:</u>** In addition to studies indicating FOSW can be complementary to loads, solar resources, and onshore wind resources in the PNW, and that FOSW can benefit late summer hydro constraints (referenced above for Question A.1.) - studies also indicate FOSW could provide large-scale coastal generation to enhance the reliability of transmission power supplies across Oregon, including the coast. For example, FOSW could provide a significant coastal power supply that could bolster

reliability and enhance resilience for communities that currently rely on power being supplied from transmission lines crossing the Coastal Range that aren't reinforced with nearby generation and are exposed to outage risks (e.g. wildfires, winter storms, etc).

(7) **Transmission Power Supply Reliability**: To what extent could FOSW provide an opportunity to bolster power system reliability for coastal communities? To what extent could FOSW bolster the reliability of power transfers across Oregon and potentially the larger region?

(8) **Power System Resilience:** To what extent could FOSW provide an opportunity to enhance power system resilience for coastal communities? To what extent could FOSW enhance the resilience of power systems in other parts of Oregon? If so, how?

Technology Questions

E. **FOSW Turbines:** Studies have indicated that scaling up the size (and therefore the capacity) of FOSW turbines is critical to achieving economies of scale that can reduce the unit cost of electricity generated by FOSW (both $/MW and $/MWh) to make it more cost-effective. The cost of electricity generated from FOSW will be the primary factor influencing the extent to which FOSW projects get developed by the power sector, and thus the scale of the benefits FOSW could provide the grid (e.g., generation diversity benefits, transmission benefits, reliability benefits, etc.).

(9) **Turbine Size:** Do you expect that the current size of commercially available FOSW turbines (e.g., 10 to 12 MW) needs to be scaled up further to generate electricity that is cost-effective in Oregon? What processes (e.g., government-funded R&D, commercial development, etc.) are you aware of globally to scale-up the size of FOSW turbines?

(10) **Technical Limitations:** Are you aware of any specific technical limitations that could impact the scaling up of FOSW turbines? If so, what are they? For example, are there physics-dictated limitations relating to the size of floating structures in the ocean capable of accommodating larger turbines or relating to the size of sea vessels capable of transporting larger blades? Limitations related to the potential for existing or upgraded port infrastructure to accommodate larger blades or floating structures? Other technical limitations?

F. **FOSW Platforms:** The literature describes floating platform technology as nascent, and identifies the cost of building these platforms as a significant factor in the overall capital costs of developing FOSW projects. The literature further identifies the need for serial production to achieve economies of scale to decrease the unit cost of building these floating platforms. To date, the largest FOSW project is 50 MW (five 9.5 MW turbines and one 2 MW pilot turbine) located 9 miles off the coast of Scotland, which was

deployed from a deep-water port using spar-buoy platform technology. Other FOSW projects have been installed using semi-submersible and tension-leg platform designs.

(11) Overall Costs: To what extent do you expect the costs of floating platforms to affect the overall cost-effectiveness and ultimate deployment of FOSW projects in Oregon and why?

(12) Costs by Platform Type: How and why do the costs of producing floating platforms vary by type of platform?

(13) Platforms for Oregon: Literature points to semi-submersible platforms as suitable for FOSW deployment from Oregon's relatively shallow water ports. Are there particular designs of floating platforms that are better suited for the deployment of FOSW in Oregon and why?

(14) Innovative Designs: Are you aware of potential new floating platform designs under development (e.g. government-funded R&D or commercial development efforts) that could significantly reduce the costs of producing them? To what extent could new floating platform designs be suitable for the deployment of FOSW in Oregon and why?

(15) Oregon Ports: Are there any coastal ports in Oregon that would be suitable for producing and deploying floating platforms for FOSW turbines? If so, why? If not, can you identify the types of upgrades at those ports that would be required to do so?

(16) Out-of-state Ports: Are there any coastal ports in Washington or California that would be suitable for producing and deploying floating platforms for FOSW turbines? If so, why? If not, can you identify the types of upgrades at those ports that would be required to do so?

(17) Reliance on Out-of-state Ports: Is the development of in-state port facilities capable of producing and deploying floating platforms for FOSW a pre-requisite for deploying FOSW projects along Oregon's coast, or could such projects be supported by port facilities in neighboring states?

Infrastructure Questions

G. Port Infrastructure: The literature identifies several port-related factors necessary to support FOSW development, such as facilities, vessels, and equipment. The literature identifies several existing ports up and down the West Coast, both inside and outside of Oregon, that currently have the necessary capabilities, or that could potentially have the necessary capability with infrastructure improvements, to support large-scale FOSW development.

(18) Single vs. Multiple Ports: To what extent do you see the establishment of a single, multifunctional port designed to support large-scale FOSW development as a pre-requisite to the deployment of FOSW projects at scale? Alternatively, could multiple ports simultaneously support the production and assembly of the components necessary for the deployment of FOSW projects at scale?

(19) Coordination of Multi-state Ports: If feasible to rely on multiple ports to support the deployment of FOSW projects at scale, could Oregon ports be used in coordination with ports in other states?

(20) Nexus with Interconnection to the Electric Grid: To what extent do considerations of points of interconnection for FOSW projects to the onshore grid have an effect on the identification of port locations to support the deployment of FOSW projects at scale? Are there particular benefits or challenges with establishing a port to support the development of FOSW projects in proximity to points of interconnection with the electric grid?

(21) Sea Vessels: What types of sea vessels are required to support the deployment of FOSW projects at scale? Do you expect that the cost and availability of the necessary sea vessels will be a limiting constraint? To what extent are restrictions imposed by the Jones Act on foreign-flagged sea vessels a constraint?

(22) Shipping Routes & Port Access: To what extent could FOSW deployment affect shipping routes and commercial sea vessel access to ports?

H. <u>Transmission Infrastructure Questions</u>: Recent literature identified multiple points of interconnection into Oregon's existing onshore electric transmission system that could potentially accommodate varying levels of FOSW generation. For example, technical studies have found that if varying levels of FOSW generation were injected across multiple interconnection points (e.g., 4-5 different substation locations along the entire length of Oregon's coastline), there could be enough existing substation and transmission line capacity to accommodate a maximum of approximately 2 GW of FOSW.

(23) Economies of Scale: Could adequate economies of scale be achieved through a distributed deployment of up to 2 GW of FOSW capacity across multiple areas of the ocean and interconnecting to multiple different onshore substations up and down the length of Oregon's coastline? Or would achieving adequate economies of scale require a more concentrated deployment of up to 2 GW (or more) of FOSW in a single ocean area?

(24) Offshore Transmission Configurations: If economies of scale favor a larger capacity of FOSW deployment (e.g., 2 GW or more) sited in a more concentrated ocean area, to what extent would multiple offshore transmission lines be needed to deliver energy to multiple interconnection points? How could the design and deployment of offshore transmission lines be optimized to deliver energy to one or more interconnection points?

(25) Existing Transmission System Limitations: Technical studies find that the existing onshore transmission system may not be capable of interconnecting more than 2 GW of FOSW capacity along the length of the entire Oregon coast, and that the largest single point of interconnection can accommodate less than 1 GW of FOSW capacity. To what extent do these existing onshore transmission limitations constrain the ability to develop FOSW projects off Oregon's coast?

(26) Onshore Transmission Upgrades: From your perspective, are significant upgrades to the onshore transmission system *required* before FOSW projects can be deployed at scale off Oregon's coast? If so, please explain the nature of the upgrades that would be required.

(27) Costs and Barriers to Transmission Upgrades: If onshore transmission upgrades are necessary to accommodate up to 2 GW of FOSW capacity, how significant would these costs be? Are there barriers to making these investments?

(28) Co-locating Storage: Could co-locating large amounts of energy storage at onshore points of interconnection (batteries at substations) or somewhere before/after onshore points of interconnection (hydrogen produced at sea or at ports) materially improve the ability of the onshore transmission system to accommodate energy from FOSW projects? Please explain why or why not, including any thoughts on how the addition of storage could impact the economic viability of FOSW.

(29) In-State & Regional Transmission Benefits: How could FOSW contribute net benefits in terms of optimizing the transfer capacities across the state, regional and interregional transmission system? Could FOSW offset the need for transmission upgrades in other areas of Oregon and the Western region? How do economies of scale for FOSW deployment interact with the potential for net benefits to the in-state and regional transmission system?

The literature also identifies many risks and constraints associated with onshore transmission infrastructure across the Western U.S. and PNW regions. For example: (1) transmission can potentially ignite wildfires; (2) transmission can be turned off to prevent wildfire ignition, or to prevent damage to transmission lines and equipment when wildfires are burning; (3) building transmission over rough terrain and long distances can be very costly; and (4) the capacity of existing transmission lines can be a

limiting constraint, especially during peak hours, which can constrain transfers of electricity necessary to keep the lights on and can constrain the development of new renewable projects.

(30) Subsea Backbone Transmission: How could new offshore and onshore transmission infrastructure necessary to accommodate larger scales of FOSW (e.g., more than 2 GW) be designed and deployed to best balance and optimize the risks, costs, and constraints associated with the region's onshore transmission infrastructure? For example, could a subsea backbone transmission line offer benefits in terms of minimizing risks and costs associated with: 1) deploying new offshore transmission, 2) upgrading onshore transmission, and 3) decreasing transfer capacity constraints of the regional and interregional transmission system? If so, please specify what those benefits could be.

(31) Optimizing Transmission: What factors should be considered when seeking the most optimal transmission system upgrades to help support potential FOSW projects along Oregon's coast? Do you have any ideas for types and locations of transmission upgrades that could optimize risks, costs, and constraints for FOSW and the onshore transmission system?

(32) Coastal Resilience: How could FOSW improve the resilience of energy supplies for coastal customers? If FOSW has resilience value, should this value be included in decisions about FOSW? Are there barriers to utilities and developers considering resilience value when making decisions regarding FOSW projects?

Energy Market & RTO Questions

I. Investors/Purchasers of Offshore Wind Output (Offtakers): To secure the financing necessary to develop FOSW projects at scale, project developers will likely need to secure long-term contracts (e.g., 20-year power purchase agreements or design-build-transfer ownership agreements) with electric utilities or another offtaker. As with any generation resource, FOSW projects would be in competition with the output from other power projects - solar, onshore wind, fossil plants, nuclear, etc. - that could also meet the needs of these utilities. Cost competition is complicated by the fact that individual utilities have unique resource portfolios and can also operate in different energy markets. For example, PGE and PacifiCorp rely on different mixes of energy supplies to serve their customers. And Oregon utilities operate in energy markets that differ from the energy markets California utilities operate in. These different characteristics may have significant impacts on how cost-effective it could be for utilities to invest in FOSW projects, or purchase FOSW generation as an offtaker.

(33) Sharing the Output: Given the size of the output from FOSW projects at scale relative to the need of individual Oregon utilities, to what extent could sharing

the output across several utilities and/or direct access customers (e.g., industrial customers, including hydrogen producers) allow for the development of larger FOSW projects with increased economies of scale relative to a single utility or industrial customer investing in a smaller scale FOSW project on its own?

(34) Barriers to Cooperative Offtake Arrangements: Do you know of specific challenges (e.g., regulatory, transmission-related, etc.) to establishing cooperative arrangements to purchase the output from large-scale FOSW projects?

(35) Out-of-State Purchasers: Given the dynamics of the power sector in the west, it is likely that utilities in other states would also have a strong interest in purchasing the output of FOSW projects located off Oregon's coast. Even if the output is purchased by out-of-state entities, what benefits (e.g., local economic development, improved reliability of coastal power systems, bulk transmission system benefits, etc.) would still be likely to accrue within Oregon? What barriers exist that could prevent these benefits from accruing in Oregon?

(36) First Mover Advantage: What are the particular advantages or disadvantages associated with the timing of when Oregon utilities purchase the output from FOSW projects? Advantages or disadvantages could relate to generation, transmission, or both. For example, while technology costs may decline over time, the first projects developed are also likely to capture the highest-value FOSW resources.

J. **Regional Transmission Organization:** In many parts of the country, regional transmission organizations (RTOs) operate the bulk power system and optimize supply and demand resources for wholesale electricity. RTOs perform a variety of functions, including: centrally managing power and transmission flows across their regional footprint, performing centralized transmission planning, ensuring reliable grid operation, and centrally managing wholesale energy market transactions.

(37) General Effects of an RTO: What specific advantages or disadvantages would you expect the formation of an RTO in the northwest to have for the deployment of FOSW? For example, how would centralized transmission planning affect FOSW development? Are you aware of specific challenges with an RTO that should be considered in the context of FOSW?

(38) BA-Specific Transmission Planning: Currently, individual Balancing Authorities in the PNW region conduct their own local transmission planning, as opposed to optimized regional transmission planning by an RTO. Are you aware of any specific challenges facing the inclusion of FOSW in transmission planning by

individual BAs in the PNW region today? What effect would an RTO have on these types of transmission planning challenges?

(39) Potential Value of a Regional Analysis: Would a more regional assessment of FOSW help assess how the benefits and challenges of onshore generation and transmission resources compete with the benefits and challenges of offshore generation and transmission resources? For example, are the benefits and challenges of building energy resources on land (e.g., risks, costs, constraints, etc.) the same or different as building in the ocean? If there are differences, could differences be complementary?

(40) Regionalization Pre-requisite: Given the scale of the infrastructure likely necessary to make FOSW economical, do you consider additional regionalization (e.g., of real-time energy markets, resource adequacy planning and procurement, and transmission planning) to be a pre-requisite before PNW entities can develop FOSW projects at scale? Or is there a realistic path to developing FOSW projects at scale without additional regionalization?

Siting & Permitting Questions: There are many local, state, tribal, and federal review processes relating to the siting and permitting of FOSW projects. Many of these review processes are designed to address the avoidance, minimization, monitoring, and mitigation of a wide range of potential effects of FOSW projects, including potential effects on ocean and land users and potential environmental effects.

(41) Process Gap Analysis: Are there any known gaps in current siting and permitting review processes that would prevent an adequate assessment of the potential adverse effects of FOSW projects, either on an individual project or cumulative effects basis?

(42) Data Gap Analysis: Are there any known gaps in data, knowledge, science, or other fact-based information related to the potential effects of FOSW projects that could result in an inadequate assessment of such projects by existing siting and permitting review processes? If yes, please describe such gaps and how they might be addressed (e.g., further research or data collection).

(43) Identification of Effects of Concern: Are there specific potential adverse effects of FOSW development that are of particular interest to you or your organization? If so, please describe.

(44) General Best Practices for Addressing Effects of Concern: Are you aware of best practices from other parts of the country or world relating to avoiding, minimizing, monitoring, or mitigating the potential adverse effects of FOSW projects? If so, please cite examples of those practices that have been used to

address specific potential effects, including potential effects on ocean and land users, and potential environmental effects.

(45) Specific Recommendations for Addressing Effects of Concern: Do you have any specific recommendations for addressing specific potential effects on ocean and land users, or potential environmental effects, that are of significant interest to you or your organization?

Miscellaneous Questions:

(46) Additional Topics: Are there specific topics or issues of significance that you believe have been overlooked in the Draft Literature Review Report the Department has produced as part of its implementation of HB 3375?

(47) Errors or Inconsistencies: Are there any specific errors or inconsistencies with existing literature in the Draft Literature Review Report the Department has produced?