Background

MISO's Resource Adequacy construct combines regional and local criteria to achieve a least-cost solution for the region

Multiple options exist for Load-Serving Entities to demonstrate Resource Adequacy:

- Submit a Fixed Resource Adequacy Plan (FRAP)
- Utilize bilateral contracts with another resource owner
- Participate in the Planning Resource Auction (PRA)

The Independent Market Monitor (IMM) reviews the auction results for physical and economic withholding

Inputs

- Local Clearing Requirement (LCR) = capacity required from within each zone
- MISO-wide reserve margin requirements, which can be shared among the Zones, and Zones may import capacity to meet this requirement above LCR
- Capacity Import/Export Limits (CIL/CEL) = Zonal transmission limitations
- Sub-Regional contractual limitations such as between MISO's South and Central/North Regions

Outputs

- Commitment of capacity to the MISO region, including performance obligations
- Capacity price (ACP = Auction Clearing Price) for each Zone
- ACP price drives the settlements process
- Load pays the Auction Clearing Price for the Zone in which it is physically located
- Cleared capacity is paid the Auction Clearing Price for the Zone where it is physically located

Changes Since 2018 Auction

TREATMENT OF EXTERNAL RESOURCES (ER18-2363):

In Oct. 2018, FERC approved MISO's filing to improve consistency between resources outside of MISO and resources external to a Local Resource Zone but within the footprint.

NEW REQUIREMENTS FOR LOAD MODIFYING RESOURCES (ER19-650):

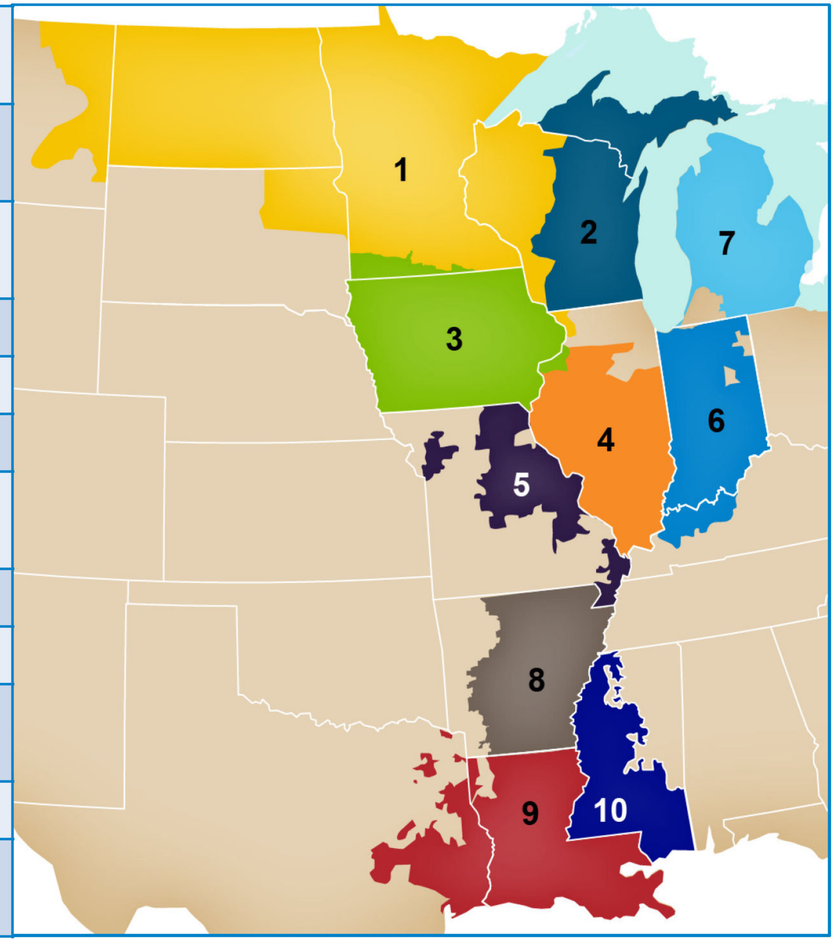
In Feb. 2019, FERC approved part of MISO's Resource Availability and Need initiative related to Load Modifying Resource (LMR) availability. LMRs must now make themselves available for as much of the year as possible and with the shortest-possible notification times.

ONGOING FLEET CHANGE:

The auction results reflect the industry's ongoing shift away from coal-fired generation and increasing reliance on gas-fired resources and renewables, as well as other trends discussed in our MISO Forward report.

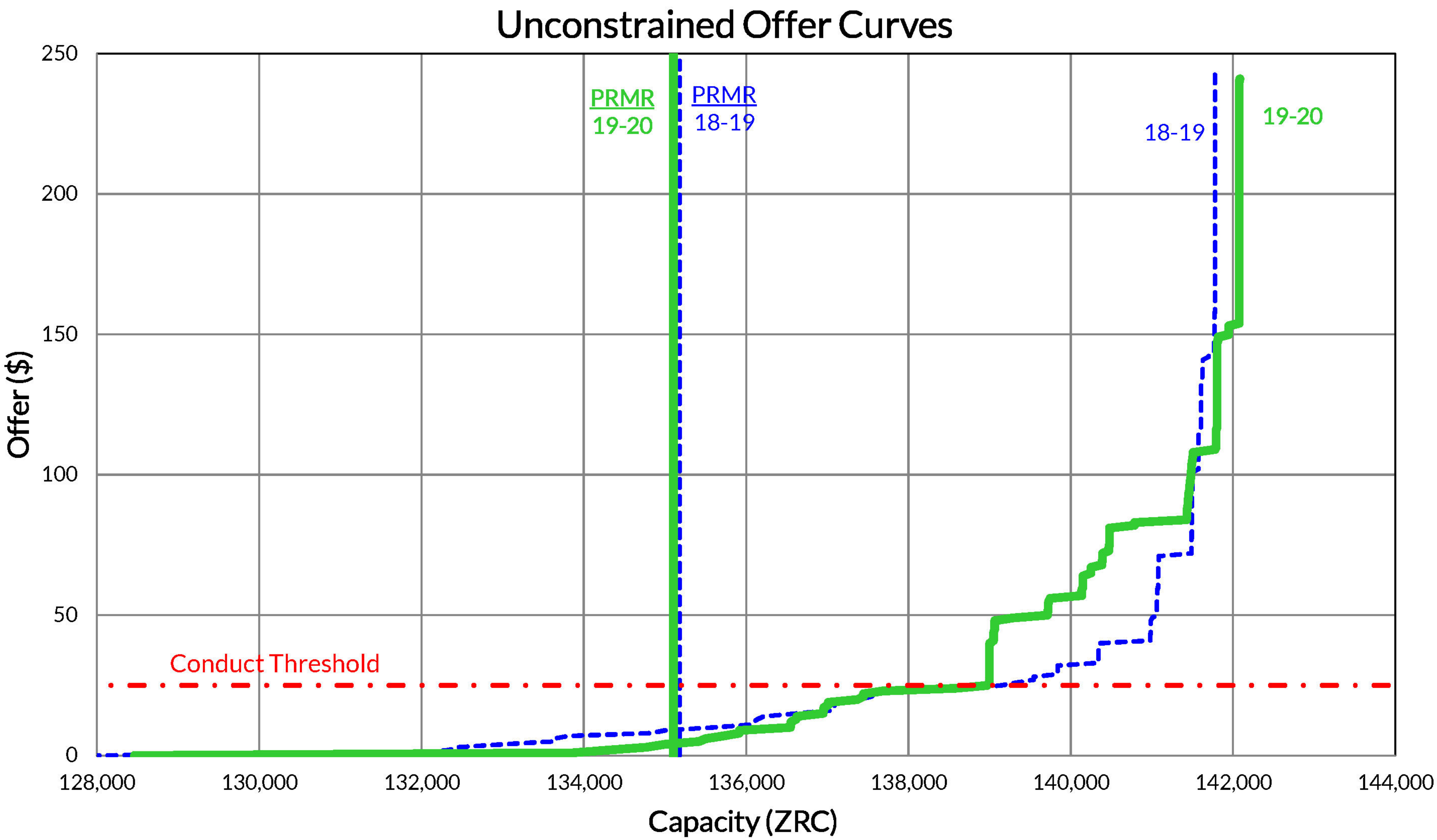
2019/2020 Auction Clearing Price Overview

Zone	Local Balancing Authorities	Price $/MW-Day
1	DPC, GRE, MDU, MP, NSP, OTP, SMP	$2.99
2	ALTE, MGE, UPPC, WEC, WPS, MIUP	$2.99
3	ALTW, MEC, MPW	$2.99
4	AMIL, CWLP, SIPC	$2.99
5	AMMO, CWLD	$2.99
6	BREC, CIN, HE, IPL, NIPS, SIGE	$2.99
7	CONS, DECO	$24.30
8	EAI	$2.99
9	CLEC, EES, LAFA, LAGN, LEPA	$2.99
10	EMBA, SME	$2.99
ERZ	SPP, PJM, OVEC, LGEE, AECI, SPA, TVA	$2.99



ERZ = External Resource Zones

Offer Curve: 2018/19 vs 2019/20



2019/20 Planning Resource Auction Results

	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8	Z9	Z10	ERZ	System
PRMR	18,374.9	13,449.9	9,882.0	9,792.3	8,297.1	18,659.8	21,976.0	7,963.5	21,350.2	4,997.3	N/A	134,743.0
Offer Submitted (Including FRAP)	20,187.3	13,575.1	11,009.4	11,428.8	7,959.7	17,946.9	22,063.2	10,611.8	21,162.4	4,593.0	1,545.0	142,082.6
FRAP	14,318.7	11,278.9	4,124.4	832.1	0.0	1,587.0	12,096.9	489.4	171.9	1,380.3	134.6	46,414.2
Self Scheduled (SS)	3,938.1	2,258.0	6,187.6	6,249.7	7,844.1	13,945.1	9,682.7	9,276.5	18,750.5	2,644.1	1,270.5	82,046.9
Non-SS Offer Cleared	404.4	0.0	79.1	1,523.7	0.0	2,069.4	32.0	443.9	1,232.7	368.9	127.8	6,281.9
Committed (Offer Cleared + FRAP)	18,661.2	13,536.9	10,391.1	8,605.5	7,844.1	17,601.5	21,811.6	10,209.8	20,155.1	4,393.3	1,532.9	134,743.0
LCR	16,588.7	13,017.5	7,960.2	6,222.1	4,860.1	13,226.1	21,811.6	6,116.3	19,525.2	3,048.8	-	N/A
CIL	3,754	1,714	2,896	6,771	5,013	7,067	3,211	4,250	3,631	3,792	-	N/A
ZIA	3,753	1,713	2,987	5,312	5,013	6,924	3,211	4,249	3,631	3,792	-	N/A
Import	0.0	0.0	0.0	1,186.8	453.0	1,058.3	164.4	0.0	1,195.1	604.0	-	4,661.6
CEL	3,373.2	978.7	4,589.7	3,770.2	2,122.0	1,434.5	1,358.0	5,263.1	2,223.6	1,721.0	-	N/A
Export	286.3	87	509.1	0	0	0	0	2,246.3	0	0	1532.9	4,661.6
ACP ($/MW-Day)	2.99	2.99	2.99	2.99	2.99	2.99	24.30	2.99	2.99	2.99	2.99	N/A

Values displayed in MW UCAP

Historical Auction Clearing Price Comparison

<table>
<tr><th>PY</th><th>Zone 1</th><th>Zone 2</th><th>Zone 3</th><th>Zone 4</th><th>Zone 5</th><th>Zone 6</th><th>Zone 7</th><th>Zone 8</th><th>Zone 9</th><th>Zone 10</th><th>ERZs</th></tr>
<tr><td>2014-2015</td><td>$3.29</td><td colspan="6">$16.75</td><td colspan="2">$16.44</td><td>N/A</td><td>N/A</td></tr>
<tr><td>2015-2016</td><td colspan="3">$3.48</td><td>$150.00</td><td colspan="3">$3.48</td><td colspan="2">$3.29</td><td>N/A</td><td>N/A</td></tr>
<tr><td>2016-2017</td><td>$19.72</td><td colspan="6">$72.00</td><td colspan="3">$2.99</td><td>N/A</td></tr>
<tr><td>2017-2018</td><td colspan="10">$1.50</td><td>N/A</td></tr>
<tr><td>2018-2019</td><td>$1.00</td><td colspan="9">$10.00</td><td>N/A</td></tr>
<tr><td>2019-2020</td><td colspan="6">$2.99</td><td>$24.30</td><td colspan="4">$2.99</td></tr>
</table>

Conduct Threshold	*24.24*	*23.88*	*23.95*	*24.22*	*24.65*	*24.05*	*24.34*	*23.23*	*22.37*	*23.12*	*24.65*
Cost of New Entry	*242.36*	*238.82*	*239.51*	*242.16*	*246.47*	*240.49*	*243.37*	*232.27*	*223.67*	*231.15*	*246.47*

- Auction Clearing Prices & are displayed as $/MW-day
- Conduct Threshold is 10% of Cost of New Entry (CONE)
- Conduct Threshold is $0 for a generator with a Facility Specific Reference Level

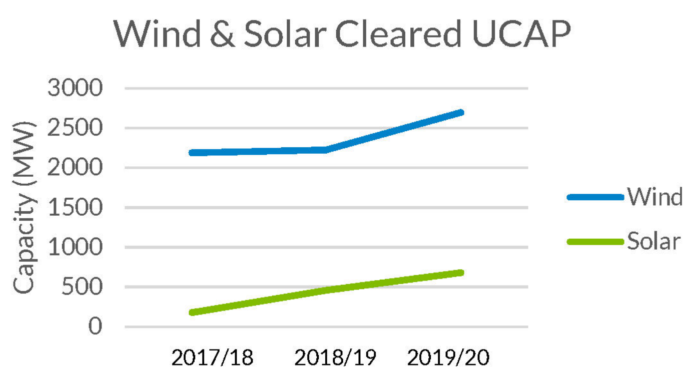
Supply Offered & Cleared

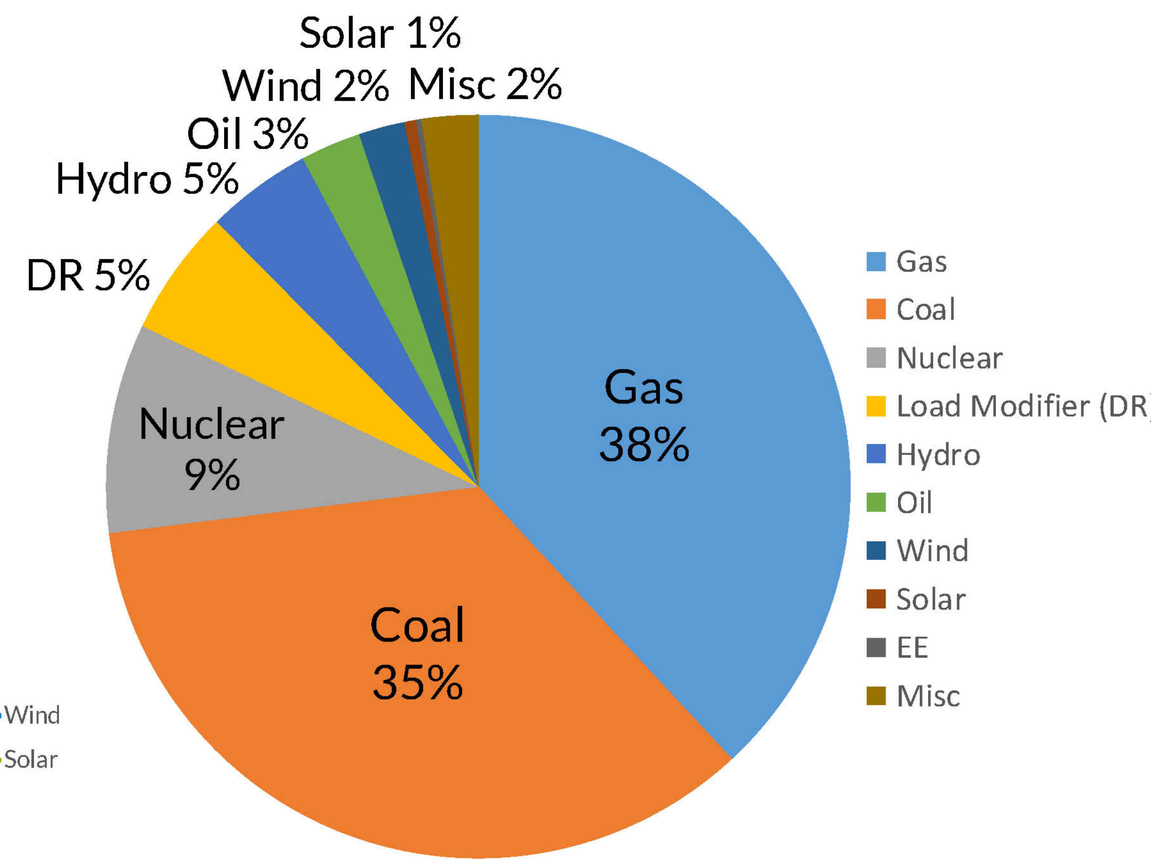
Planning Resource Type	2018-2019 Offered	2019-2020 Offered	2018-2019 Cleared	2019-2020 Cleared
Generation	126,159	125,290	120,855	119,779
External Resources	3,903	4,402	3,089	3,183
Behind the Meter Generation	4,176	4,202	4,098	4,097
Demand Resources	7,370	7,876	6,964	7,372
Energy Efficiency	173	312	173	312
Total	**141,781**	**142,082**	**135,179**	**134,743**

2019 Cleared Fuel Type

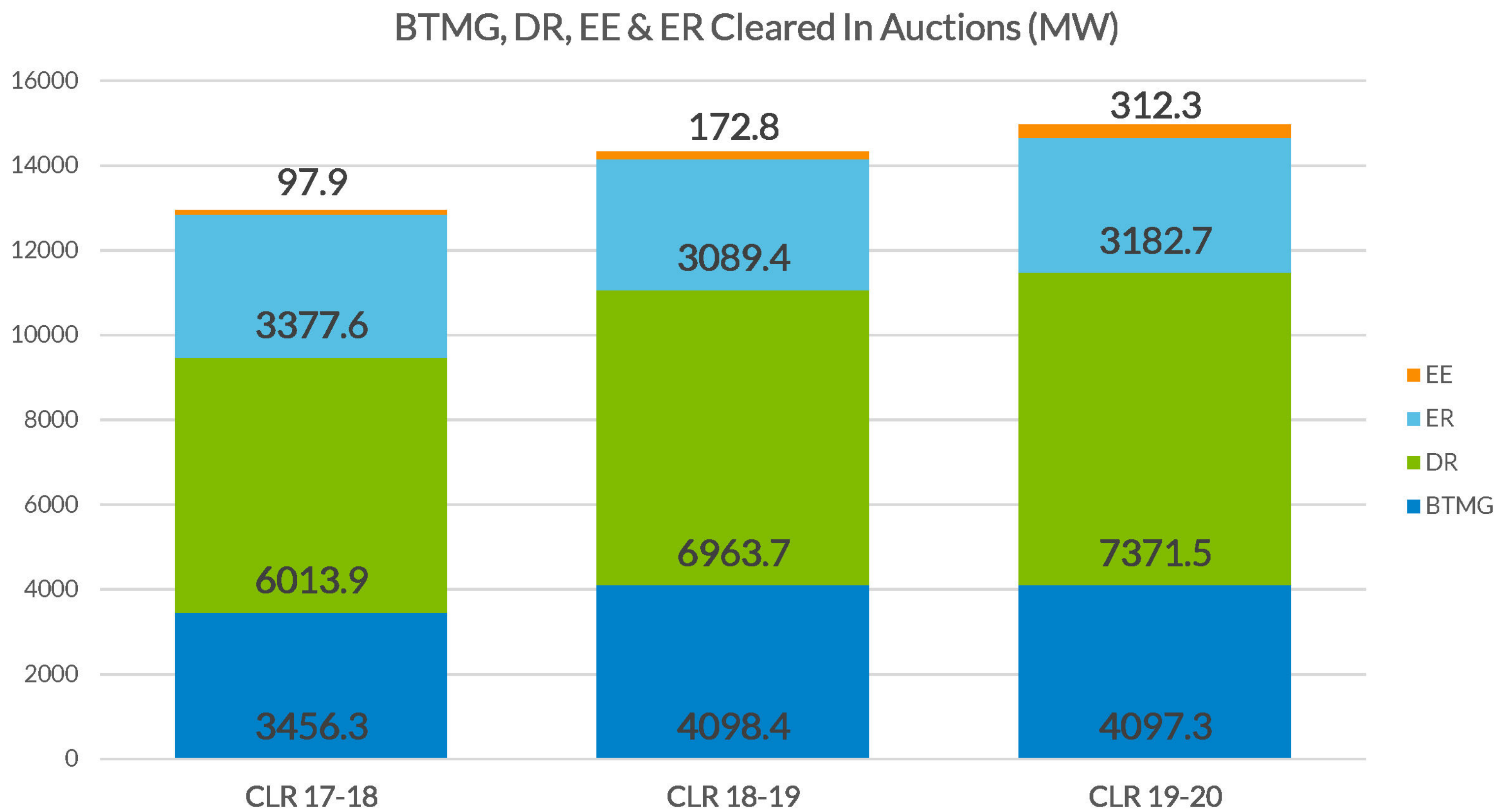
While solar still comprises a relatively small percentage of the region's total capacity, 680 MW of solar cleared this year's auction—an increase of 47% over last year's mark of 461 MW.

Similarly, 2,698 MW of wind cleared this year, an increase of 21%, or 469 MW, compared to last year.





Non Traditional Resources



Next Steps

- APR 15 – Conference call presentation of PRA results
- MAY 8 – Detailed results review at RASC
- MAY 13 – Posting of PRA offer data
- MAY 31 – LSE submit ICAP Deferral info
- JUN 1 – New Planning Year starts

Appendix

Acronyms

ACP: Auction Clearing Price
ARC: Aggregator of Retail Customers
BTMG: Behind the Meter Generator
CIL: Capacity Import Limit
CEL: Capacity Export Limit
CONE: Cost of New Entry
DR: Demand Resource
EE: Energy Efficiency
ER: External Resource
ERZ: External Resource Zones
FRAP: Fixed Resource Adequacy Plan
ICAP: Installed Capacity
IMM: Independent Market Monitor
LCR: Local Clearing Requirement
LMR: Load Modifying Resource
LRZ: Local Resource Zone
LSE: Load Serving Entity
PRA: Planning Resource Auction
PRM: Planning Reserve Margin
PRMR: Planning Reserve Margin Requirement
RASC: Resource Adequacy Sub-Committee
SS: Self Schedule
SFT: Simultaneous Feasibility Test
UCAP: Unforced Capacity
ZIA: Zonal Import Ability
ZRC: Zonal Resource Credit

MISO

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https://www.nola.com/news/environment/article_2a752480-3b82-11ed-b892-1bbc5fc1d7b6.html

Entergy partners with offshore wind developer to explore Gulf of Mexico potential

Louisiana companies were instrumental in the development of the Block Island Wind Farm, the United States' first commercial offshore wind farm. It is located in state waters of Rhode Island. Entergy Corp. said it is actively exploring potential offshore wind projects in the Gulf of Mexico, a possibility that could help wean Louisiana's power sector off fossil fuels and transition to renewables, in line with the state's climate goals.

PHOTO BY SARAH RAVITS

BY SAM KARLIN | STAFF WRITER
SEP 23, 2022 - 3:56 PM

Entergy Corp. said it is actively exploring potential offshore wind projects in the Gulf of Mexico, a possibility that could help wean Louisiana's power sector off fossil fuels and transition to renewables, in line with the state's climate goals.

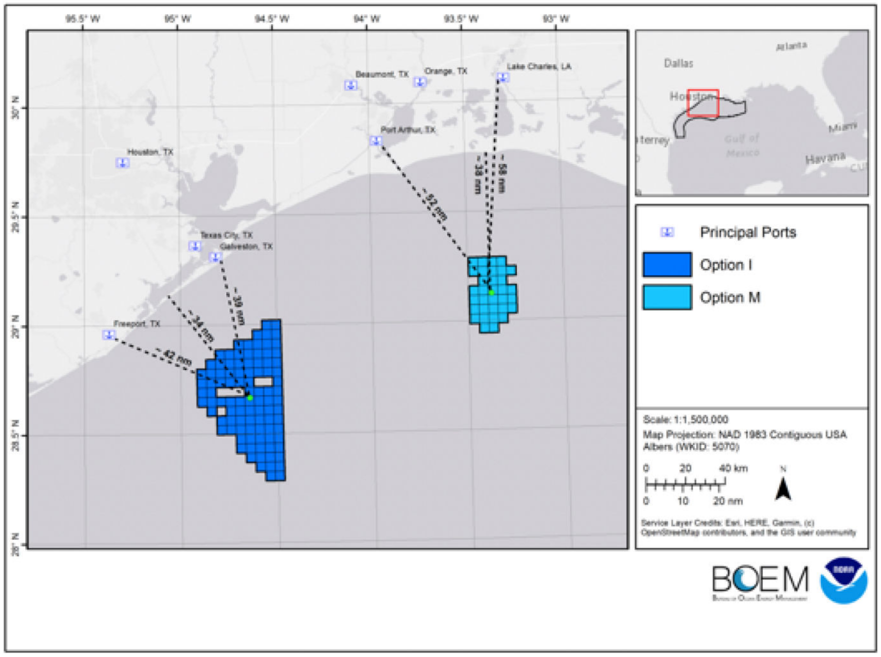
Entergy Louisiana, Entergy New Orleans and Diamond Offshore Wind signed a memorandum of understanding to evaluate "potential early development" of offshore wind power in Louisiana state waters, the companies announced Friday.

Gov. John Bel Edwards' climate task force, which seeks net zero carbon emissions by 2050, calls for getting 5 gigawatts of power from offshore wind generation by 2035. The climate goals have helped draw interest in the Gulf from some of the world's biggest wind developers, and Entergy's announcement makes them the latest to set their sights off the Louisiana coast.

Leaders hope wind power could provide clean energy and resurrect the state's offshore economy, which for decades employed thousands in the oil sector.

The announcement Friday is a very early step in the process. To build offshore wind farms in state waters, developers would need to ask the Department of Natural Resources to do a lease sale for an area, which would trigger a public bid process.

The Legislature this year passed a bill that updated the state's bid laws to account for wind projects. They also passed a resolution asking the Public Service Commission to assess an offshore wind pilot project by 2026.



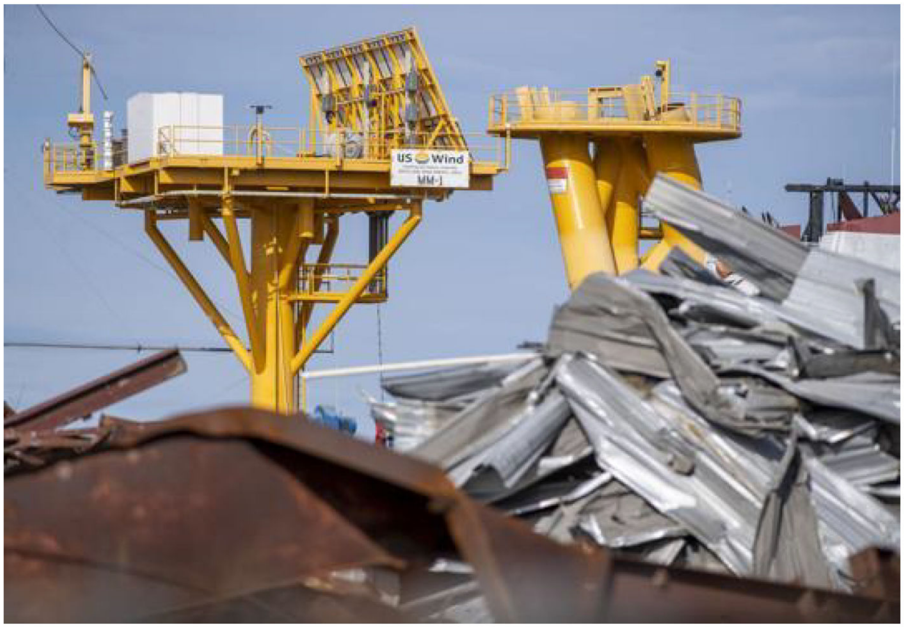
The U.S. Bureau of Ocean Energy Management is proposing two offshore wind energy zones in the Gulf of Mexico. The zone near Lake Charles could generate enough energy to power 800,000 homes.

BOEM

This week, Public Service Commissioner Craig Greene issued a directive to utilities to evaluate the costs and benefits of offshore wind power in their long-range resource planning.

"The LPSC is interested in knowing how every tool in the tool box can be used to deliver reliable and affordable electricity to Louisiana residents and businesses," Greene said Friday. "This is why the commission directed each utility to fully analyze the feasibility of offshore wind as each company carries out their resource planning. I look forward to seeing what those evaluations tell us about Louisiana's future with offshore wind."

"This is an important first step to possibly bring wind power to our Louisiana shores," said Phillip May, Entergy Louisiana president and CEO in a prepared statement. "While there remains work to be done before that happens, we are excited by the opportunity to begin this process."



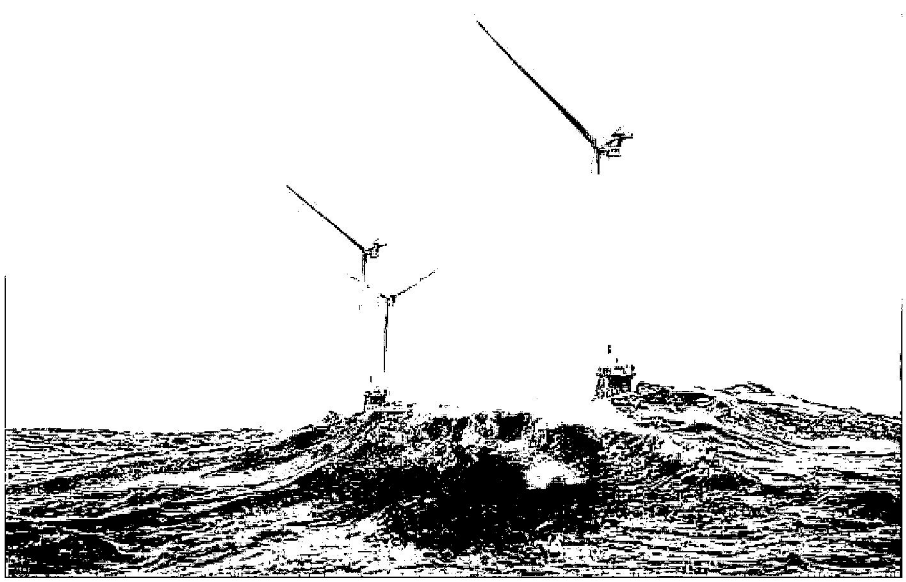
A wind turbine platform for the state of Maryland rises near a scrap yard for offshore ships and oil industry related machinery in Houma.

PHOTO BY CHRIS GRANGER / THE TIMES-PICAYUNE

The memorandum of understanding sets up a legal framework for Entergy and Diamond Offshore to eventually develop wind projects and to evaluate how to connect those projects into the transmission grid. Ensuring that the power generated from offshore breezes can find its way to residential and commercial customers is a key component of developing wind farms.

Entergy still gets the vast majority of its power from natural gas, which fires its large generating units; 76% of power in Louisiana comes from natural gas. But it has taken small steps of late to diversify. This week, the Public Service Commission approved a deal that will see Entergy Louisiana get 475 megawatts of solar power from four projects around Louisiana. That's a small share of the nearly 12,000 megawatts in Entergy Louisiana's portfolio.

Diamond Offshore is a subsidiary of the Mitsubishi Corporation. The firm said in a news release it has developed seven commercial scale offshore wind projects and 12 offshore wind transmission projects.



The Block Island Wind Farm near Rhode Island takes a beating from waves in 2016. The wind farm was the first to operate in U.S. waters. Several Louisiana companies with roots in the offshore oil and gas industry helped design and build the farm.

U.S. Department of Energy

The Gulf waters off of the Texas coast have greater wind potential than off the Louisiana coast, but Louisiana's climate task force has helped draw interest towards the state. Meanwhile, federal regulators are looking to set up a wind energy zone in the Gulf near Lake Charles as part of President Joe Biden's push to get 30 gigawatts of offshore wind power by 2030.

United States Department of the Interior

BUREAU OF OCEAN ENERGY MANAGEMENT

New Orleans Office

1201 Elmwood Park Boulevard
New Orleans, LA 70123-2394

Memorandum

To: Amanda Lefton
Director, Bureau of Ocean Energy Management

From: Michael Celata
Regional Director, Gulf of Mexico Regional Office

Subject: Request for Concurrence on Preliminary Wind Energy Areas for the Gulf of Mexico Area Identification Process Pursuant to 30 C.F.R. § 585.211(b)

I. Purpose

This memorandum documents the analysis and rationale used to develop recommendations for Preliminary Wind Energy Areas (WEAs) in the Gulf of Mexico. The BOEM New Orleans Office is requesting concurrence from the Director of the Bureau of Ocean Energy Management (BOEM) on the Preliminary WEAs in order to obtain further stakeholder input on the WEA development process.

II. Recommended Preliminary WEAs

As described in 1 and depicted in

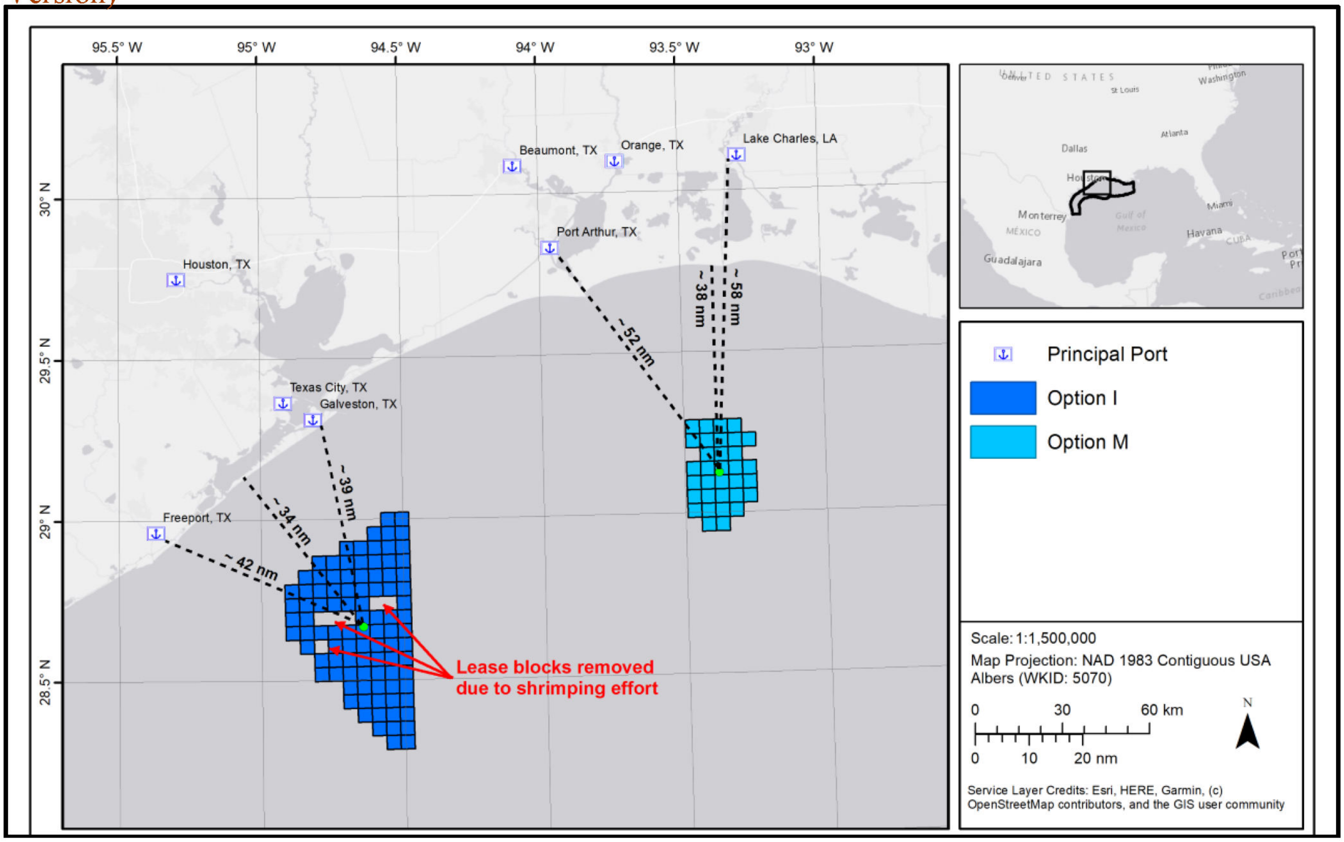


Figure 1 and 2, the recommended Preliminary WEAs for the Gulf of Mexico consist of 734,668 total acres.

Table 1: GOM Preliminary WEAs Descriptive Statistics

	Galveston Preliminary WEA (Option I)	**Lake Charles Preliminary WEA (Option M)**	**Total**
Acres	546,645	188,023	734,668
Installation Capacity[1]	6,636	2,283	8,919
Homes powered[2]	2,322,600	799,050	3,121,650
Power Production (MWh/yr)[3]	23,252,544	7,999,632	31,252,176
Max Depth (meters)	253	25	
Min Depth (meters)	16	10	
Closest distance to TX (nm)	24 (45 km)	79 (147 km)	
Closest distance to LA (nm)	28 (52 km)	56 (104 km)	

[1] Megawatts (MW) based upon 3MW/sqkm
[2] Megawatt hours per year (MWh/yr) based upon 350 homes per MW
[3] Formula = Capacity (MW) * 8760 (hrs/yr) * 0.4 (capacity factor)

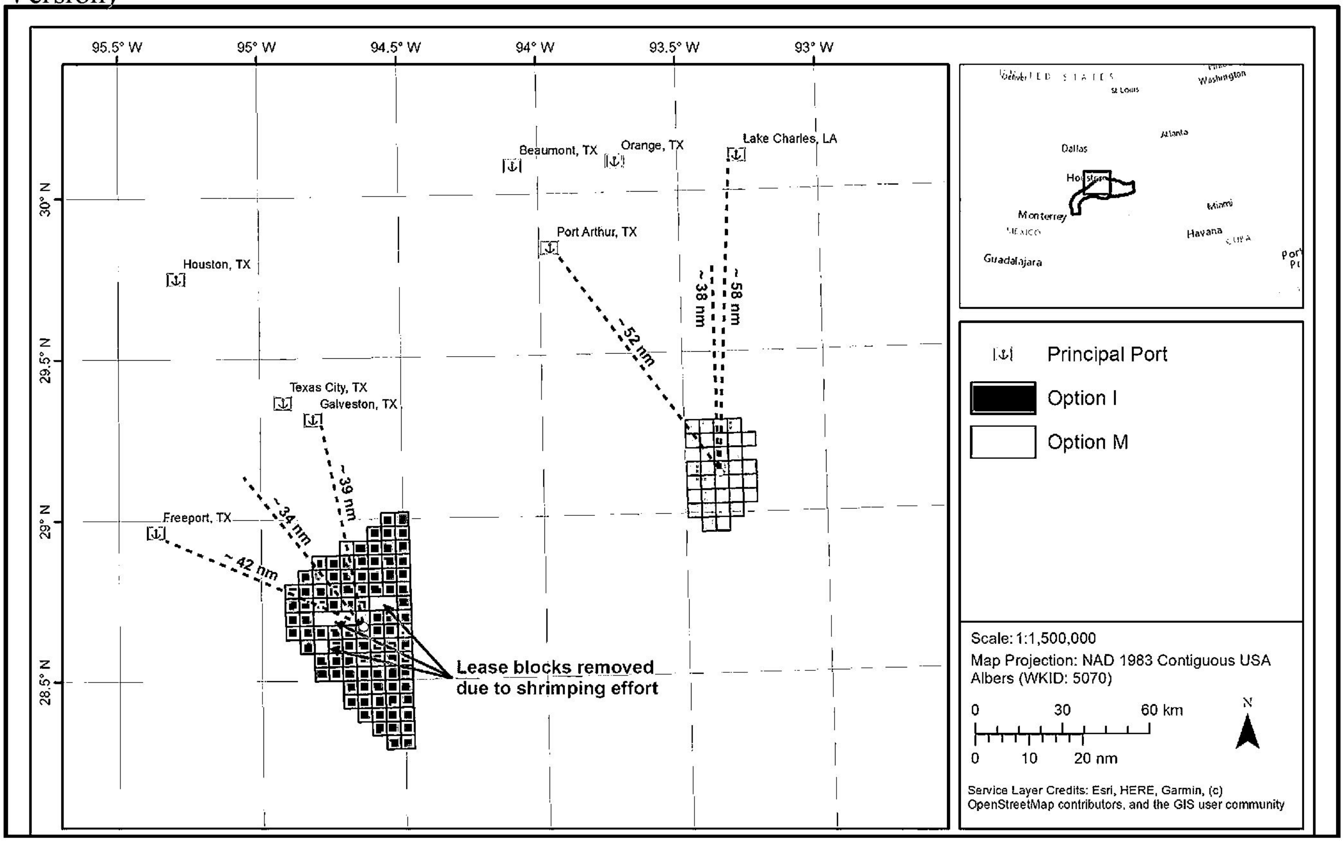


Figure 1: Map of the Gulf of Mexico Wind Energy Area offshore Texas and Louisiana

III. Legal Standard

Pursuant to subsection 8(p)(1)(C) of the Outer Continental Shelf Lands Act (OCSLA), the Secretary of the Interior (Secretary), in consultation with the U.S. Coast Guard (USCG) and other relevant Federal agencies, may grant a lease, easement, or right-of-way on the Outer Continental Shelf (OCS) for activities that "produce or support production, transportation, or transmission of energy from sources other than oil and gas" (43 U.S.C. § 1337(p)(1)(C)). The Secretary must ensure that activities under this subsection are carried out in a manner that provides for 12 different goals ("OCSLA factors"), including safety, protection of the environment, and consideration of other uses of the sea or seabed. *Id.* § 1337(p)(4)(A)–(L). BOEM has issued regulations governing the leasing process and management of offshore renewable energy projects. *See* 74 Fed. Reg. 19,638 (Apr. 29, 2009); *see also* 30 C.F.R. part 585.

This memorandum documents BOEM's consideration of the OCSLA factors for identifying Preliminary WEAs during the Area ID determination within its leasing process (43 U.S.C. § 1337(p)(4)(A), (B), (D), (F), (I), and (J)), as explained further in Section IV below. The identification of Preliminary or Final WEAs does not constitute a final leasing decision, and BOEM reserves the right under its regulations to issue leases in smaller, fewer and/or different areas—or issue no leases. Moreover, BOEM may conduct additional Area ID processes within the Gulf of Mexico in the future. After publicizing the Preliminary WEAs, BOEM will conduct further analysis under OCSLA and the National Environmental Policy Act (NEPA) at subsequent stages of its process, (1) before the lease auction and (2) when renewable energy facilities are proposed on those leases.

IV. Development of Preliminary WEAs and the Area Identification Process

Overview:

BOEM's competitive lease issuance process starts with the publication of an optional Request for Interest (RFI) or a mandatory Call for Information and Nominations (Call), which requests comments from the public about areas of the OCS that they believe should receive consideration and analysis for the potential development of renewable energy (30 C.F.R. § 585.211(a)). The RFI may not always be necessary to assist BOEM in determining potential interest in offshore wind and BOEM could move directly to publication of the Call when there is sufficient information to inform the Call process. For the Gulf of Mexico (GOM), BOEM decided it was prudent to issue an RFI to gauge specific interest in obtaining commercial wind leases in an area on the OCS in the GOM.

All comments received on the RFI, and the Call are submissions from private citizens; Federal, State, and local government agencies; environmental and other advocacy groups; industry groups; and wind developers. The RFI and Call comments are then used to inform the Area ID process.

An Area ID process is a required step under the renewable energy competitive leasing process used to identify areas for environmental analysis and consideration for leasing (30 C.F.R. § 585.211(b)). The Area ID process takes into consideration multiple competing uses and environmental concerns that may be associated with a proposed area's potential for commercial wind energy development. The development of Preliminary WEAs and seeking public comment on these areas is not required under BOEM's regulations. However, in this instance, BOEM believes that such processes will result in a more transparent and inclusive Area ID process.

BOEM prepares an Environmental Assessment (EA), pursuant to NEPA, before any lease sale. The objective of the environmental analysis is to estimate the nature, severity, and duration of impacts that might occur from site assessment and site characterization activities and to compare the impacts of the various alternatives for a proposed OCS wind energy lease sale. Potential impacts of a specific proposed renewable energy facility in the identified areas would be addressed during the review of a Construction and Operations Plan (COP) when post-lease information is available.

A. Request for Interest

On June 11, 2021, BOEM issued an RFI for Commercial Leasing for Wind Power Development on the GOM OCS to gauge interest in obtaining commercial wind leases in area on the OCS offshore GOM and to gather information about the RFI Area. The RFI Area comprised the entire Central Planning Area (CPA) and Western Planning Area (WPA) of the Gulf of Mexico, excluding the portions of those areas located in water depths greater than 1,300 meters (Figure 2). BOEM issued the RFI to identify potential opportunities for renewable energy development in the GOM and to gather additional information about possible constraints. In addition to soliciting public comment in the *Federal Register*,[4] BOEM held its first GOM Intergovernmental Renewable Energy Task Force meeting on June 15, 2021. The Task Force meeting included representatives

[4] https://www.regulations.gov/document/BOEM-2021-0041-0001

of the Louisiana, Texas, Mississippi, and Alabama State governments, as well as other representatives from Tribes, and relevant Federal and local government entities.

The comment period for the RFI ended on July 26, 2021. BOEM received 39 comments and 10 nominations, which are available at https://www.regulations.gov/document/BOEM-2021-0041-0001.

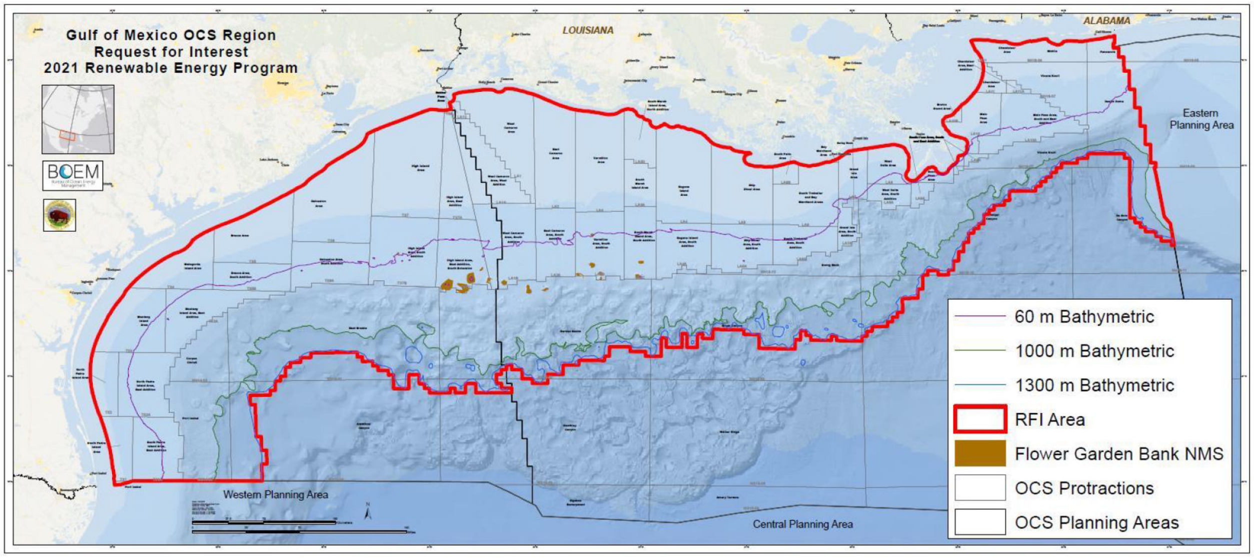


Figure 2: Gulf of Mexico RFI Area

B. Call

On November 1, 2021, BOEM published a Call for Wind Power Development on the OCS in GOM.[5] The Call Area comprised the area located seaward of the Gulf of Mexico Submerged Lands Act Boundary, bounded on the east by the north-south line located at -89.857° W. longitude, and bounded on the south by the 400-meter bathymetry contour, and the U.S. Mexico Maritime Boundary established by the Treaty between the Government of the United States of America and the Government of the United Mexican States on the Delimitation of the Continental Shelf in the Western Gulf of Mexico beyond 200 Nautical Miles (U.S.-Mexico Treaty), which took effect in January 2001.

BOEM delineated the Call Area taking into account the comments from the RFI and consultation with numerous parties and information sources, including the States of Alabama, Mississippi, Louisiana, Texas, and the Intergovernmental Renewable Energy Task Force (Figure 3). In addition to soliciting public comment in the *Federal Register*,[6] BOEM hosted a second task force meeting on February 2, 2022. The Task Force meeting included participation from members of all involved States, as well as other representatives from Tribes and relevant Federal and local government entities. BOEM also hosted four sector specific fisheries meetings to collect information that would help to avoid, minimize, or mitigate potential impacts on commercial and recreational fisheries and fishing. During and after the Call Area comment period, BOEM held or

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[5] https://www.federalregister.gov/documents/2021/11/01/2021-23800/call-for-information-and-nominations-commercial-leasing-for-wind-power-development-on-the-outer

[6] https://www.regulations.gov/docket/BOEM-2021-0077

attended over forty informational sessions with many stakeholders to better understand concerns related to potential impacts to military activities, fisheries, navigation, and other potential use conflicts.

The comment period for the Call ended on December 16, 2021. BOEM received 40 comments and 8 nominations, which are available at https://www.regulations.gov/document/BOEM-2021-0077.

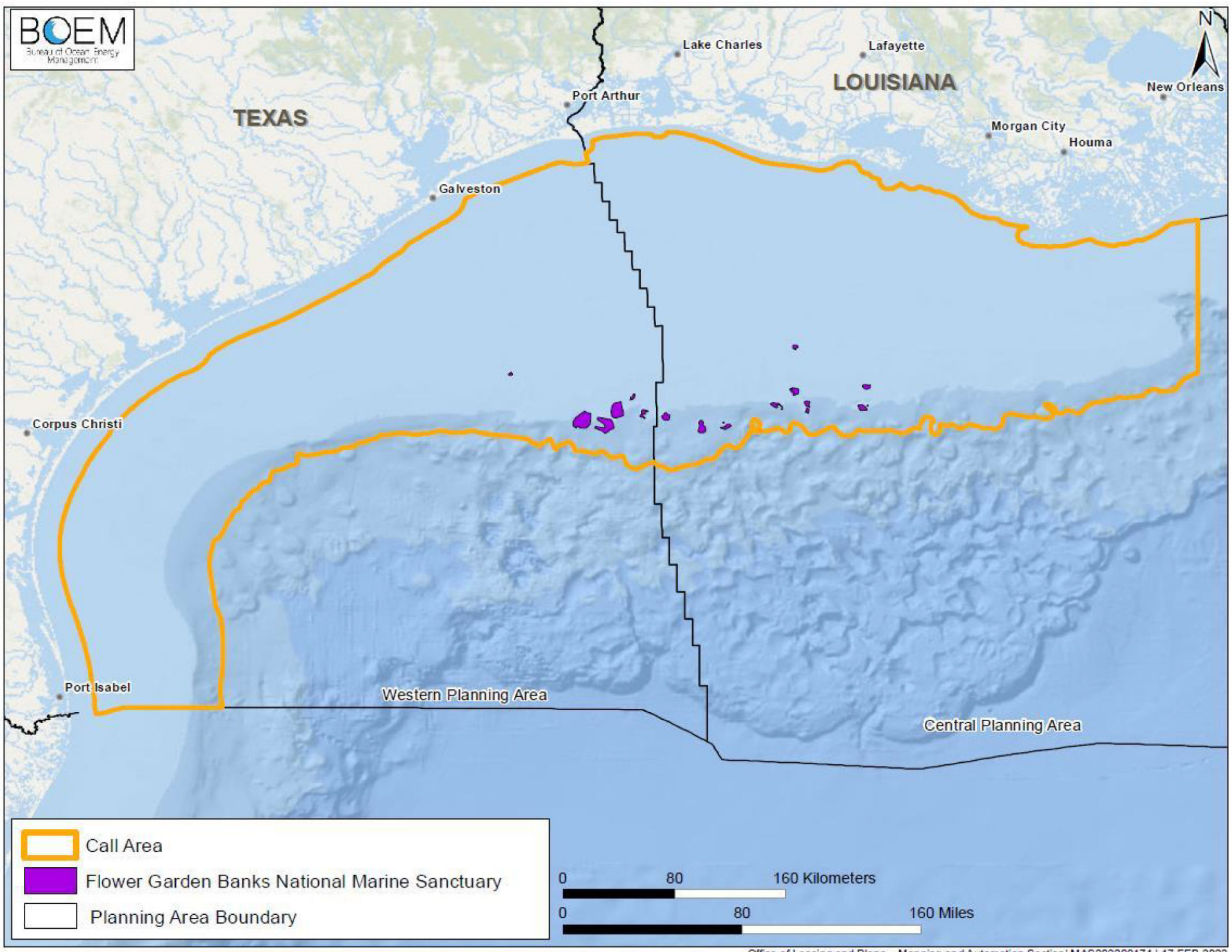

Figure 3: Gulf of Mexico Call Area

C. GOM Preliminary WEAs and Area ID

For purposes of recommending the Preliminary WEAs, BOEM considered the following non-exclusive list of information sources: comments and nominations received on the RFI and Call; information from the GOM Intergovernmental Renewable Energy Task Force; input from Alabama, Mississippi, Louisiana, and Texas State agencies; input from Federal agencies (e.g. DoD, USCG); comments from stakeholders and ocean users, including the maritime community, offshore wind developers, and the commercial fishing industry; state and local renewable energy goals; and information on domestic and global offshore wind market and technological trends.

BOEM received ocean users feedback to consider leveraging an existing ocean planning model previously used in the GOM for National Oceanic and Atmospheric Administration's (NOAA) Aquaculture Opportunity Areas for ocean planning purposes. In response, BOEM used the ocean planning model to help support identification of Preliminary WEAs.

1. Ocean Planning

BOEM's process to identify Preliminary WEAs in the GOM was based on rigorous science to drive an informed, forward-looking, and sustainable industry to maximize operational efficiency and limit adverse interactions with other industries or natural resources. Additionally, the Gulf of Mexico Regional Office of BOEM (GOMR) and the NOAA National Centers for Coastal Ocean Science (NCCOS) collaborated utilizing an ocean planning tool to identify Preliminary WEAs in the Federal waters of the GOM. Due to its vast richness of data and decades of active management in the GOM, BOEM was able to utilize this tool in the region. Preliminary WEAs are identified, based on the best available science and through public engagement, to facilitate wind energy development; support environmental, economic, and social sustainability; and minimize resource use conflicts. The WEA process seeks to identify and minimize potential conflicts in ocean space as well as to mitigate interactions with other users and adverse interactions with the environment, the NCCOS model is a tool to help support that effort.

2. Study Area

The Call Area as defined in Section IV.B was also used as the study area boundaries. (See Figure 4).

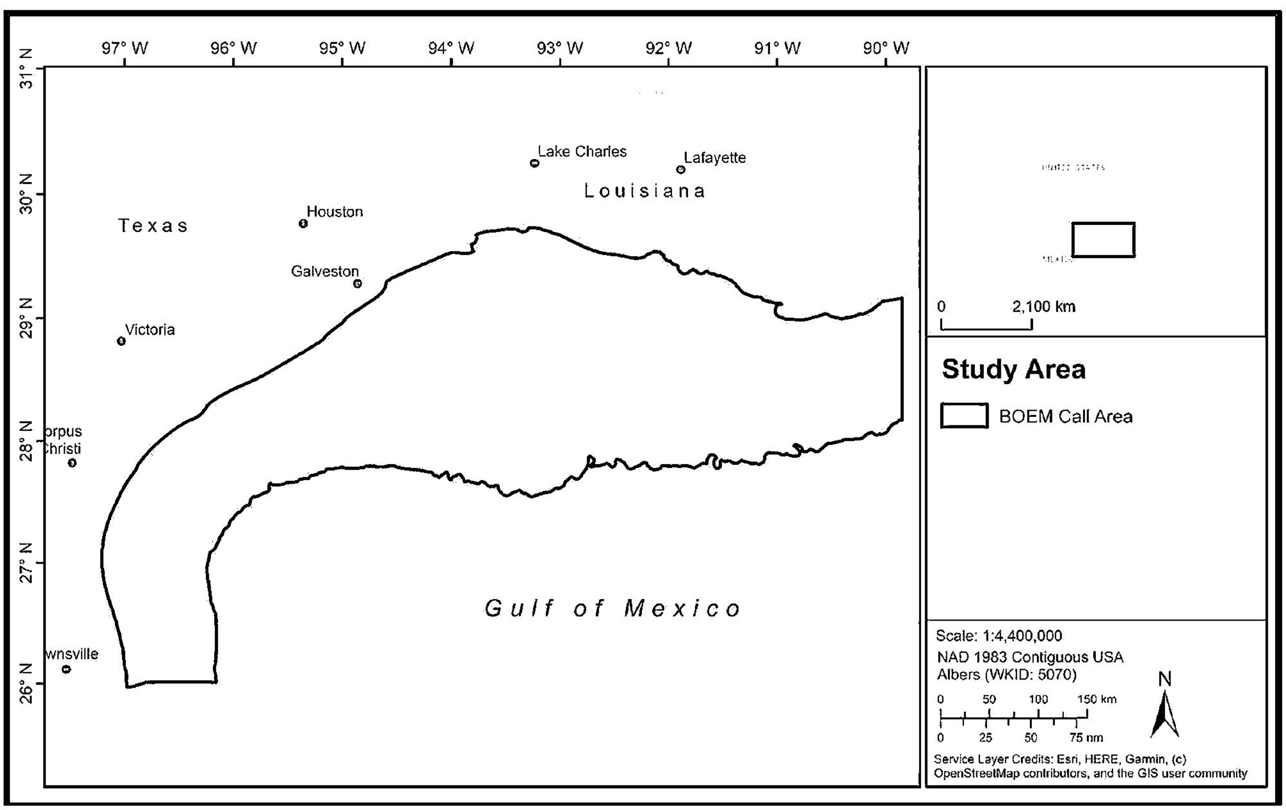

Figure 4: Gulf of Mexico Study Area for Ocean Planning

3. *WEA Planning*

Planning and siting for the WEAs requires thorough synthesis and spatial analyses of critical environmental data and ocean space use conflicts. BOEM used Geographic Information Systems (GIS) to integrate pertinent spatial data, perform analyses, and generate map-based products to inform where potential wind energy area(s) may be located within the Call Area. BOEM seeks to identify wind energy areas in a manner that avoids or minimizes impacts to environmental resources. The use of this model is one approach to meet that objective.

Historically, BOEM has engaged in similar ocean planning efforts in other OCS Regions. Ocean planning processes often follow a standard workflow by 1) identification of the planning objective, 2) inventory of data, 3) geospatial analysis of data, 4) interpretation of results, and 5) delivery of map products and reports to decisionmakers and other ocean users. Spatial data are used to represent known or potential environmental and ocean space use conflicts that could constrain, or conditionally constrain, the siting of offshore wind facilities in Federal waters. Using a multi-criteria decision approach allows for evaluation of numerous spatial data types for an area and provides a relative comparison of how suitable the areas are for offshore wind development. Additionally, natural and cultural resources, industry and operations, various fishing activities, logistics, economics, and national security are described and identified in the WEA model suitability analysis which is discussed in detail in *Gulf of Mexico Wind Energy Area Modeling Report.*

Additionally, WEA siting informed by ocean planning is helpful in avoiding and minimizing adverse environmental, social, and existing user interactions. Throughout the Area ID process, BOEM used existing datasets to have discussions with ocean users to receive early feedback. BOEM incorporated the feedback from ocean users in the spatial and temporal planning strategies to allow initial compatibility to be assessed, while also increasing efficiency of meaningful communications within and among stakeholders, and potentially with industry. The Preliminary WEAs resulting from this analysis are then considered by the decisionmaker to inform the siting of offshore wind in the GOM.

4. *Ocean Planning Model: Step-by-Step Approach*

In BOEM's Area ID process, the determination of the Preliminary WEAs requires an understanding of the relationship between different elements of the environment and ocean use as well as the practical requirements for offshore wind development. Developing a model for an expansive region like the Gulf of Mexico requires compilation and analysis of best-available data. A step-by-step approach was developed for ocean planning using a logical workflow that began with framing the research questions (i.e., number of acres needed for a wind facility), data collection and inventory, then continued with spatial suitability modeling, identifying potential WEA options using a unique precision siting modeling strategy, further characterization of options, and finally, interpretation of results. Each step of the workflow diagram corresponds to an essential step of the study, with corresponding methods detailed in the *Gulf of Mexico Wind Energy Area Modeling Report* (Figure 5).

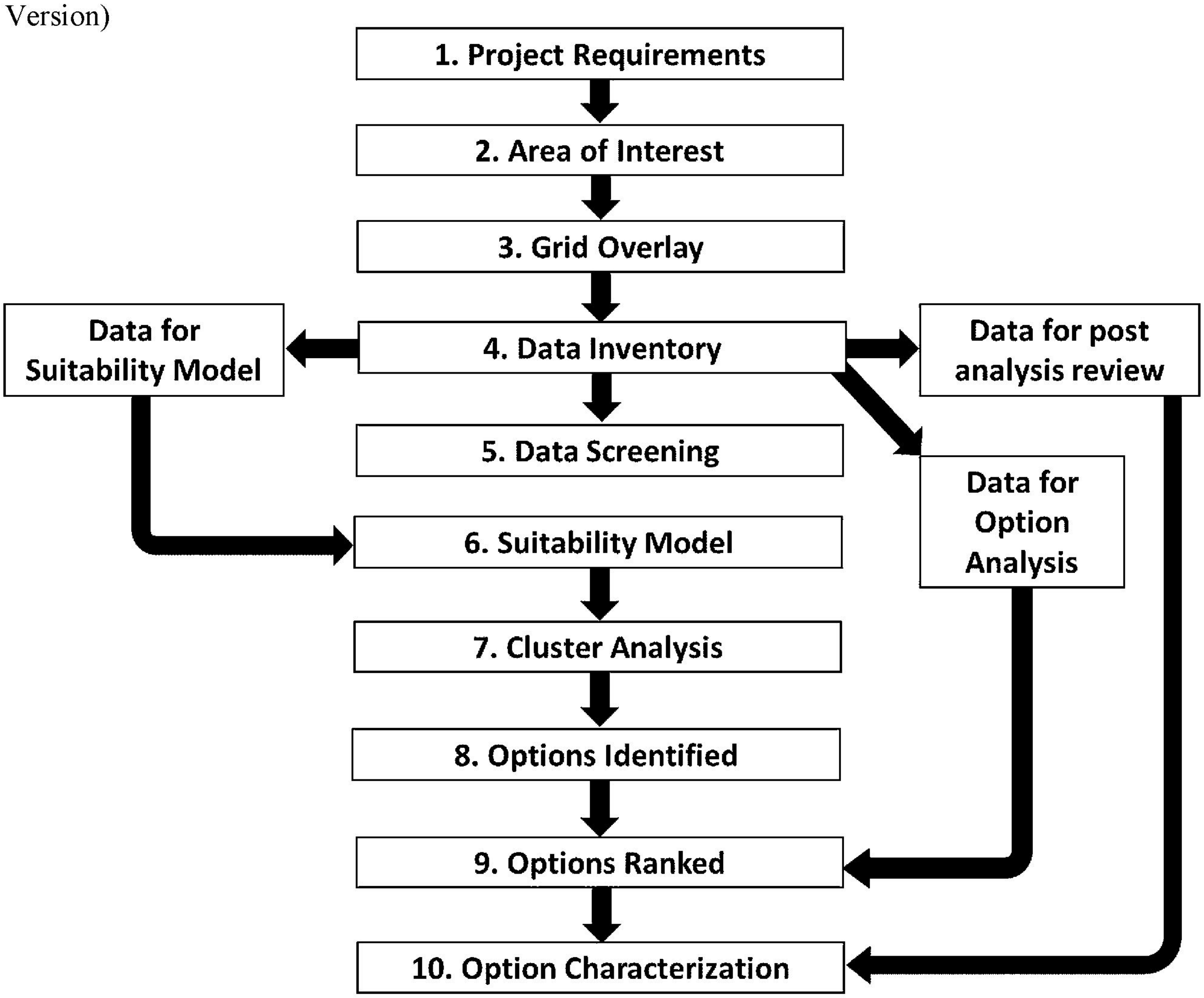

Figure 5: Workflow for Wind Energy Area options spatial analysis for the Gulf of Mexico Call Area

Geospatial analysis for identification of WEA options was based on a categorical framework to ensure relevant, comprehensive data acquisition and characterization for spatial suitability modeling. An authoritative spatial data inventory was developed that included data layers relevant to administrative boundaries, national security (i.e., military), navigation and transportation, energy and industry infrastructure, commercial and recreational fishing, natural and cultural resources, and oceanography. With over 200 data layers included in this analysis, the maps, models, and descriptions provide the most comprehensive marine spatial modeling in the GOM to date.

a. *Grid Overlay*

Based on world-wide historical trends for acreage for wind energy facilities, this spatial modeling approach was specific to the planning goal of identifying discrete areas ranging from 40,000 to 80,000 acres that met the distance of more than 20 nm from shore with a maximum water depth of 400 meters. These industry and engineering requirements of water depth and distance from shore and are the most suitable for all types of wind energy development in the GOM. Ocean planning was performed at 10-acre (4.05-ha) hexagon grid cell resolution providing high contrast of suitability (Figure 6). A hexagon grid was used because it fits organic shapes and curves (ex. pipeline, submarine cable, etc.) better than square grids, and it provides advantages for statistical analysis as all neighboring cells share a side and the distance from the center is the same distance to all neighboring cells. [7]

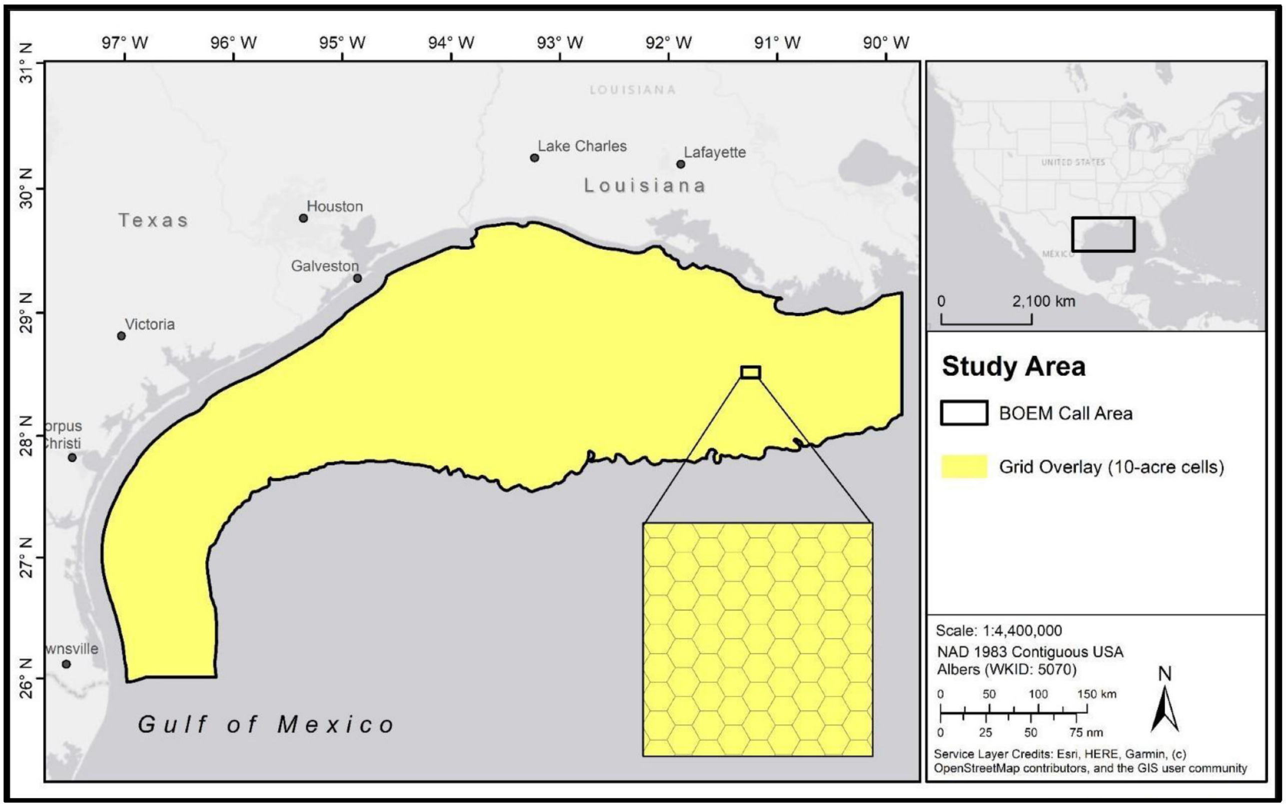

Figure 6: An example of grid cells formulated for the Call Area. Each cell is a 10-acre or 4.05-ha hexagon.

b. *Data Acquisition, Categorization, and Inventory*

Geospatial analyses and ocean planning require the consideration of multiple, authoritative datasets that require substantial data acquisition to properly understand and implement within ocean planning suitability models. Spatial suitability modeling is a type of multi-criteria analysis that provides BOEM with the ability to calculate a relative suitability score for each grid cell in an area. Data categorization is needed to describe the relationship among the data input into the models and to organize information into appropriate submodels for relative suitability modeling. Data categorization was modified from the schema provided in Lightsom et al. (2015) as the intent of the categorical structure is for ocean planning. The structure intends to bring transparency and a consistent framework for organizing complex and dynamic ocean systems.[8] The framework works to include necessary data that are needed for the wind energy area site suitability analysis, a specific type of ocean planning.

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[7] Birch CPD, Oom SP, Beecham JA. 2007. Rectangular and hexagonal grids used for observation, experiment, and simulation in ecology. Ecol Model. 206(3-4):347–359.

[8] Lightsom FL, Cicchetti G, Wahle CM. 2015. Data categories for marine planning: U.S. Geological Survey open-file report 2015–1046.

Acquisition of spatial data is a key factor in model success because it is the base for further calculations and analysis.[9] BOEM completed an initial review to determine the broad suite of data and categories needed to properly support this ocean planning process. BOEM then developed a comprehensive, authoritative spatial data inventory including data layers relevant to national security, natural and cultural resources, industry and operations, fisheries, logistics, and economics. BOEM developed the data holdings through engagement with non-governmental organizations and U.S. Federal and State agencies representing a diverse array of stakeholders. The Marine Cadastre and many studies conducted throughout the years by BOEM's environmental studies program were used to supply data for the study.

BOEM evaluated data for completeness and best quality, and used the most authoritative, up-to-date sources available. All data were projected, and calculations performed using the NAD 1983 Contiguous USA Albers projection (WKID: 5070, Projection: Albers, False Easting: 0.0, False Northing: 0.0, Central Meridian: -96.0, Standard Parallel 1: 29.5, Standard Parallel 2: 45.5, Latitude of Origin: 23.0). The *Gulf of Mexico Wind Energy Area Modeling Report* provides a list of data used for this ocean planning analysis.

c. *Data Processing Steps*

Many datasets required processing prior to use in the suitability model, subsequent cluster analysis, or for the option ranking model and characterization. Methods are provided for all data that required processing in the *Gulf of Mexico Wind Energy Area Modeling Report*; many data were received in a ready-to-use format and processing notes can be found in metadata provided by the data originator. BOEM applied setbacks (i.e., buffers) when they were established by governance, policy, or regulations. In cases where an established setback requirement was not available from an authoritative source, BOEM used conservative professional judgment when assigning setback distances.

d. *Suitability Analysis*

BOEM performed a gridded relative suitability analysis, commonly used in a multi-criteria decision analysis, to identify the grid cells with the highest suitability for WEA development in the Call Area.[10] Spatial data layers included in the suitability analysis identify space-use conflicts and environmental constraints such as active national security areas, maritime navigation, active oil and gas infrastructure, and natural resource management. We used a submodel structure to capture ocean use and conservation concerns including national security, natural and cultural resources, industry and operations, fisheries, logistics, and economics (Figure 7). This submodel structure ensures that each submodel is given equal weight in the final suitability model regardless of how many data layers are present in each submodel. Constraints are reflected in data layers identifying areas of reduced compatibility (e.g., shipping fairways, known sand resources areas, or Rice's Whale habitat) and those areas are removed from further analysis at this time due to the

[9] Molina JL, Rodríguez-Gonzálvez P, Molina M-C, González-Aguilera D, Balairon L., Espejo Almodóvar F, Montejo J. 2013. River morphodynamics modelling through suitability analysis of geomatic methods. In: Wang Z, Lee JHW, Gao J, Cao S, editors. Proceedings of the 35th IAHR World Congress, Chengdu, China. Beijing: Tsinghua University Press.

[10] Mahdy M, Bahaj AS. 2018. Multi criteria decision analysis for offshore wind energy potential in Egypt. Renewable energy, *118*, 278-289.

availability of other less conflicted areas that would meet current known demand. The data layers used in the constraint model can be found in Table 2.

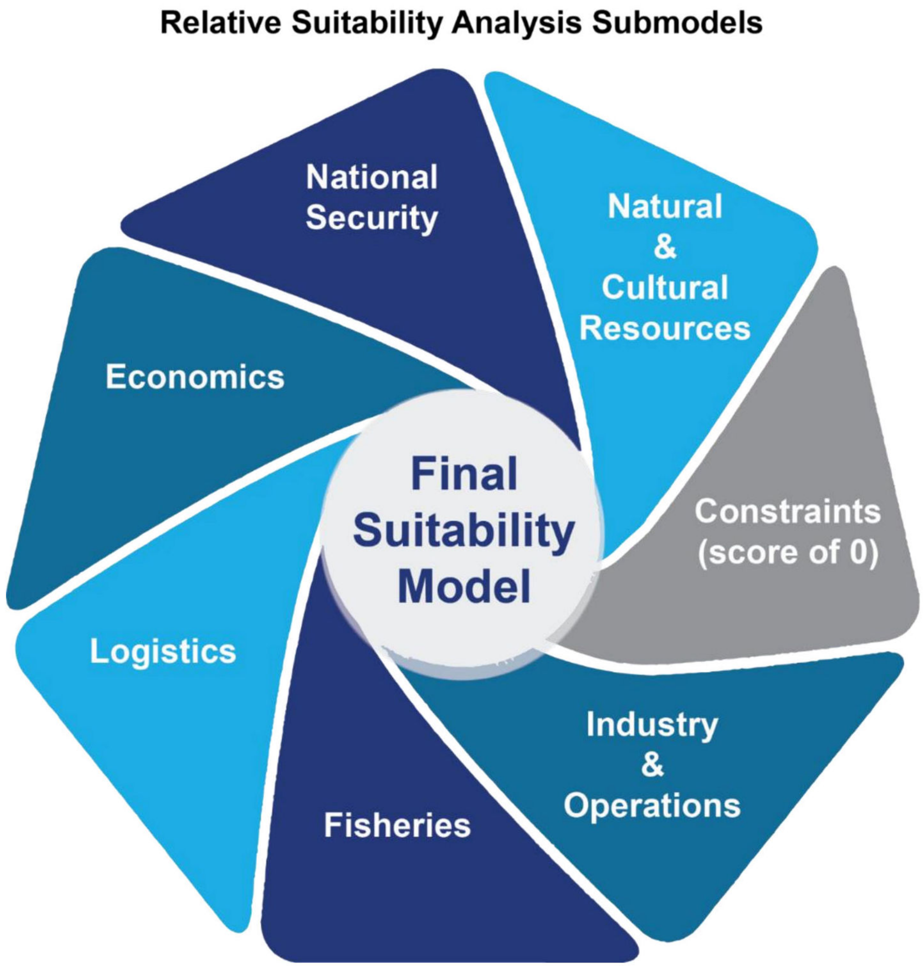

Figure 7: Overview of relative suitability model design and the submodel components. The constraints submodel includes all data layers with a score of 0; these data layers were removed before the remaining submodel scores were calculated.

d.1 Scoring Categorical Data

BOEM evaluated categorical datasets (i.e., in which data are distinct and separate groups) to determine if a constraining feature was present or absent in each grid cell. If a feature was absent, a score of 1 was given indicating suitability with offshore wind energy development, otherwise a score ranging from 0 to 1 was assigned (0 = unsuitable with offshore wind energy development; 1 = more suitable with offshore wind energy development). For example, a regulated shipping lane that experiences regular traffic would be deemed unsuitable for offshore wind energy and thus receive a score of 0 and be treated as completely unsuitable. However, within certain military operating areas where uncertainty exists, additional communications and resources may be required to determine suitability. As a result, a score of 0.5 would be given to capture that uncertainty.

After we gathered and integrated all data into the greater data inventory, certain data layers with constraints also required, either by action agency or for safety and security reasons, setbacks from the discrete/categorical layer. If a setback (i.e., existing oil and gas infrastructure) was established by a permitting authority as a 'no go' area, a score of 0 was applied as the setback (e.g., shipping lanes and a 2 nm setback from the outer boundary, all scored as 0). Based on governance, policy and regulations, BOEM used the most conservative setback distances to avoid interactions with other ocean activities (Table 2). Table 2 and Figure 8 present a summary of the constraints that are likely to limit offshore wind energy development either because of environmental sensitivities or high level of conflict with other ocean industries. The constraints submodel in total overlapped with 67% of the Call Area. BOEM used the best available science and the degree of conflict to assign scores. If there is potential for interaction with a transient resource, but uncertainty remains as to what that interaction is with wind industry infrastructure, then varying scores were assigned. These scores range from 0.2 to 0.7. A detail analysis of the scores can be found in the *Gulf of Mexico Wind Energy Area Modeling Report*.

Table 2: Constraints submodel data layers included in the relative suitability analysis. Each dataset in the constraints submodel was scored 0 for complete avoidance. A dash denotes when a dataset did not have a setback applied.

Data Layer	**Setback Distance**	**Score**
Vessel Monitoring System (VMS) Shrimp Fishing areas of Moderate-High fishing	-	0
20 nm coastal buffer	-	0
Shipping Fairways and Regulations	2 nm	0
Rice's whale 100 m to 400 m	-	0
Active Oil and Gas Lease Blocks (Including FGBNMS Blocks)	-	0
BOEM Lease Blocks with Significant Sediment Resources	-	0
BOEM No Activity Zones	-	0
Oil and Gas Pipelines (Only Active Pipelines)	200 ft	0
Menhaden Fishing - Area between 90° - 91° out to 20 miles	-	0
Oil and Gas Boreholes, Test Wells, and Wells	200 ft	0
Anchorage Areas (used/disused)	-	0
Oil and Gas Drilling Platforms	500 ft	0
Submarine Cables	500 ft	0
Unexploded Ordnance (UXO) polygon	-	0
Louisiana permitted artificial reefs	500 ft	0
Aids to Navigation (beacons and buoys)	500 m	0
Texas permitted artificial reefs	1000 ft	0
Environmental Sensors and Buoys	500 m	0

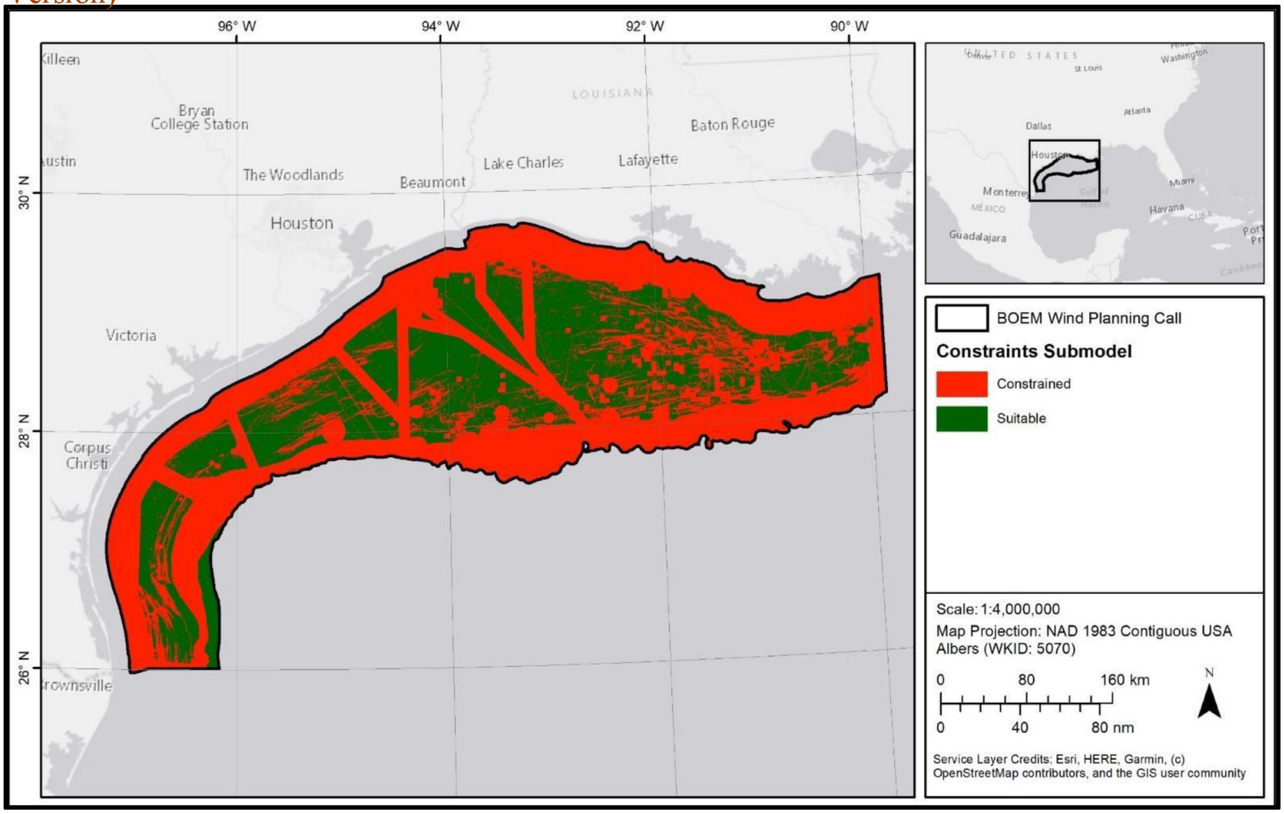

Figure 8: Constraints submodel relative suitability for the Call Area. Red color indicates those areas constrained by ocean activity, while green areas are considered potentially suitable for offshore wind development.

d.2 Scoring Numerical Data

BOEM reclassified the numerical data (i.e., data can represent any value within a given range) (e.g., continuous data) to a 0 to 1 scale using a linear function or fuzzy logic membership functions.[11] The fuzzy membership functions are similar to a linear or non-linear functional approach, however, use of fuzzy logic membership functions accounts for additional uncertainty when assigning scores to the data.[12] The function used for each numerical dataset was chosen based on the data and known interactions or compatibility with offshore wind energy development. The range of the numerical datasets (i.e., the minimum and maximum values) were used as the inputs for creating the function and were modified to ensure no output value would equal 0. BOEM did not use 0 values because no observed value in any numerical dataset used was sufficient to warrant complete exclusion from consideration for offshore wind energy infrastructure.

BOEM used the Z-shaped membership function from the Scikit-Fuzzy (Version 0.4.2) Python library to determine if vessel traffic, low fishing effort, and pelagic bird habitat suitability datasets were compatible with wind energy. If the dataset had a higher observed value (e.g., fishing effort,

[11] Vafaie F, Hadipour A, Hadipour V. 2015. GIS-based fuzzy multi-criteria decision-making model for coastal aquaculture site selection. Environ Eng Manage J. 14(10):2415–2425.

[12] Kapetsky JM, Aguilar-Manjarrez J. 2013. From estimating global potential for aquaculture to selecting farm sites: perspectives on spatial approaches and trends. In: Ross LG, Telfer TC, Falconer L, Soto D, Aguilar-Manjarrez J, editors. Site selection and carrying capacities for inland and coastal aquaculture. FAO/Institute of Aquaculture, University of Stirling, Stirling (UK), Expert Workshop, 6–8 December 2010. FAO Fisheries and Aquaculture Proceedings No. 21. Rome: FAO. p. 129–146.

vessel traffic) then it resulted in lower compatibility with wind energy, and thus the lower the suitability score.[13] Other numerical datasets, such as distance to shore, used a standard linear function because of high certainty that the closer a location is to shore, the more suitable a wind energy area is regarding logistics and cost.[14] The categorical and numerical data used in scoring for the relative suitability analysis are in Tables 3 through 8, with a detailed list and rationale for each score found in the *Gulf of Mexico Wind Energy Area Modeling Report*.

Table 3. National security submodel data layers included in the relative suitability analysis and the score assigned to each dataset. Scores closer to 0 are less suitable for wind energy development, while scores closer to 1 are more suitable.

Data Layer	Score
Military Operating Area (MOA)- Corpus Christi	0.3
Military Operating Area (MOA)- New Orleans	0.5
Military Training Routes (MTR)- Flight Corridors - 12-mile setback	0.3
Special Use Airspace (SUA) A381 - Alert Area LOOP facility	0.5
Special Use Airspace (SUA) Warning Area - W59A, W59B, W54A, W54B, W54C, W92, W147A, W147B, W147C, W147D, W228A, W228B, W228C, W228D	0.5 – Area B in the WEA options was eliminated due to W228A Warning Area.

Table 4: Natural and cultural resources submodel data layers included in the relative suitability analysis and the score assigned to each dataset. Scores closer to 0 are less suitable for wind energy development, while scores closer to 1 are more suitable.

Data Layer	Score
NOAA Fish Havens (500-ft setback included in polygon)	0.7
Potentially Sensitive Biological Features provided by FGBNMS (1000-ft)	0.5
Low Relief Structures provided by FGBNMS (1000-ft setback)	0.5
BOEM's Potentially Sensitive Biological Features (250-ft setback)	0.2
Existing Coral HAPCs (with regulations and without regulations)	0.2
Coral 9 HAPC (no regulations and regulated areas)	0.2
Protected Resource Division Combined Layer	BOEM/NMFS values
U.S. Fish and Wildlife Service (FWS) - GOMAPPS 24 Pelagic Bird Spp. Habitat Suitability	Z Membership Function

Table 5: Industry and operations submodel data layers included in the relative suitability analysis and the score assigned to each dataset. Scores closer to 0 are less suitable for wind energy development, while scores closer to 1 are more suitable.

Data Layer	Score
Federal Lightering Rendezvous Areas	0.5

[13] Warner J, Sexauer J, scikit-fuzzy, twmeggs, alexsavio, Unnikrishnan A, Castelão G, Pontes FA, Uelwer T, pd2f, et al. 2019. JDWarner/scikit-fuzzy: Scikit-Fuzzy version 0.4.2. Zenodo. Available from: https://doi.org/10.5281/zenodo.3541386

[14] Abdel-Basset M, Gamal A, Chakrabortty RK, Ryan M. 2021. A new hybrid multi-criteria decision-making approach for location selection of sustainable offshore wind energy stations: A case study. Journal of Cleaner Production, 280, 124462.

Outside of Potential Carbon Capture Blocks	0.5
NEXRAD Sites	0 - 35 km = 0 35 -70 km = 0.5
NMFS's Fishery-Independent Surveys	Z membership function
AIS Vessel Traffic 2019 – Cargo	Z membership function
AIS Vessel Traffic 2019 – Fishing	Z membership function
AIS Vessel Traffic 2019 – Other	Z membership function
AIS Vessel Traffic 2019 – Passenger	Z membership function
AIS Vessel Traffic 2019 – Pleasure and Sailing	Z membership function
AIS Vessel Traffic 2019 – Tanker	Z membership function
AIS Vessel Traffic 2019 – Tug and Tow	Z membership function

Table 6: Logistics submodel data layers included in the relative suitability analysis and the score assigned to each dataset. Scores closer to 0 are less suitable for wind energy development, while scores closer to 1 are more suitable.

Data Layer	**Score**
Distance to shore	Linear function (Closer to shoreline is better)
Distance to ports	Linear function (Closer to principal port is better)
Water Depth	Linear function (Shallower depth is better)

Table 7: Economics submodel data layers included in the relative suitability analysis and the score assigned to each dataset. Scores closer to 0 are less suitable for wind energy development, while scores closer to 1 are more suitable.

Data Layer	**Score**
National Renewable Energy Laboratory (NREL) Revenue Model - Netvalue2015 [15]	Linear function (Greater net value is better)
Competitive Lease Blocks	Cells outside =0.5, Cells inside =1

Table 8: Fisheries submodel data layers included in the relative suitability analysis and the score assigned to each dataset. Scores closer to 0 are less suitable for wind energy development, while scores closer to 1 are more suitable.

Data Layer	**Score**
Commercial Shrimp Electronic Logbook Data (2015 - 2019) Mean days fished per year	Z membership function - The moderate, mod/high, and high effort data categories (natural breaks) are included in the constraints model.

[15] Musial W, Beiter P, Stefek J, Scott G, Heimiller D, Stehly T, Tegen S, Roberts O, Greco T, Keyser D (National Renewable Energy Laboratory and the Alliance for Sustainable Energy, LLC, Golden, CO). 2020. Offshore wind in the US Gulf of Mexico: regional economic modeling and site-specific analyses. New Orleans (LA): Bureau of Ocean Energy Management. 94 p. Contract No.: M17PG00012. Report No.: OCS Study BOEM 2020-018. https://espis.boem.gov/final%20reports/BOEM_2020-018.pdf

Menhaden Fishery Data (2000 - 2019)	Z membership function - Area between 90° - 91° strata (coastal Louisiana) out to 20 miles are used in the constraints model.
Highly Migratory Species Pelagic Longline Gear (2011-2020)	Z membership function
Reef Fish Bandit Gear Fishing Data (2007 - 2021)	Z membership function
Reef Fish Longline Gear Fishing Data (2007 - 2021)	Z membership function
Southeast Region Headboat Survey Data (2014 - 2020)	Z membership function

e. Calculation of the Final Score

Each data layer was scored on a 0 to 1 scale, with scores approaching 0 representing low suitability and 1 representing high suitability relative to the other grid cells for offshore wind energy development. All constraints data layers were not considered for offshore wind energy development at this time and therefore, not further considered in the analysis. Next, a final suitability score was calculated for each submodel by taking the geometric mean of all scores within each grid cell. The geometric mean of all submodels was used to calculate a final overall suitability score. The geometric mean was chosen because it grants equal importance to each variable.[16, 17, 18, 19] All data layers and submodels had equal weight within the suitability model.

f. Final Suitability

The final suitability results for all submodels are presented in Figure 9. Several suitable areas were distributed off the east coast of Texas to southwest Louisiana. It is important to note that these suitability results are reflective of the planning objective to identify wind energy areas. In the Gulf of Mexico region, wind energy opportunities may exist under different planning objectives or at different scales than suitable for WEAs if the project rules are changed to < 40,000 acres.

The cluster analysis identified 2,398,150 acres of high-high clusters (p=.05), which are groups of cells with high values that are statistically significant. Based on the cluster analysis, there are 14 potential WEA options that ranked in the top five percent, ranging from 39,836 ac to 546,645 ac (Figure 10) that were identified. After the model had been run, DoD submitted its preliminary assessment of the Call Area. As a result of the DoD preliminary assessment, WEA Option B was eliminated from further consideration. With the elimination of Option B, there are now 13 WEA options. BOEM has selected Option I (Galveston) and Option M (Lake Charles) as the recommended Preliminary WEAs for the GOM. A detailed analysis of the rationale for the selection can found in Section VI.

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16 Bovee KD. 1986. Development and evaluation of habitat suitability criteria for use in the instream flow incremental methodology. Instream Flow Information Paper 21, Report 86(7), U.S. Fish and Wildlife Service.

17 Longdill PC, Healy TR, Black KP. 2008. An integrated GIS approach for sustainable aquaculture management area site selection. Ocean Coastal Manage. 51(8–9): 612–624.

18 Silva C, Ferreira JG, Bricker SB, DelValls TA, Martín-Díaz ML, Yáñez E. 2011. Site selection for shellfish aquaculture by means of GIS and farm-scale models, with an emphasis on data poor environments. Aquaculture. 318(3-4):444–457.

19 Muñoz-Mas R, Martínez-Capel F, Schneider M, Mouton AM. 2012. Assessment of brown trout habitat suitability in the Jucar River Basin (Spain): Comparison of data-driven approaches with fuzzy-logic models and univariate suitability curves. Sci Total Environ. 440:123–131.

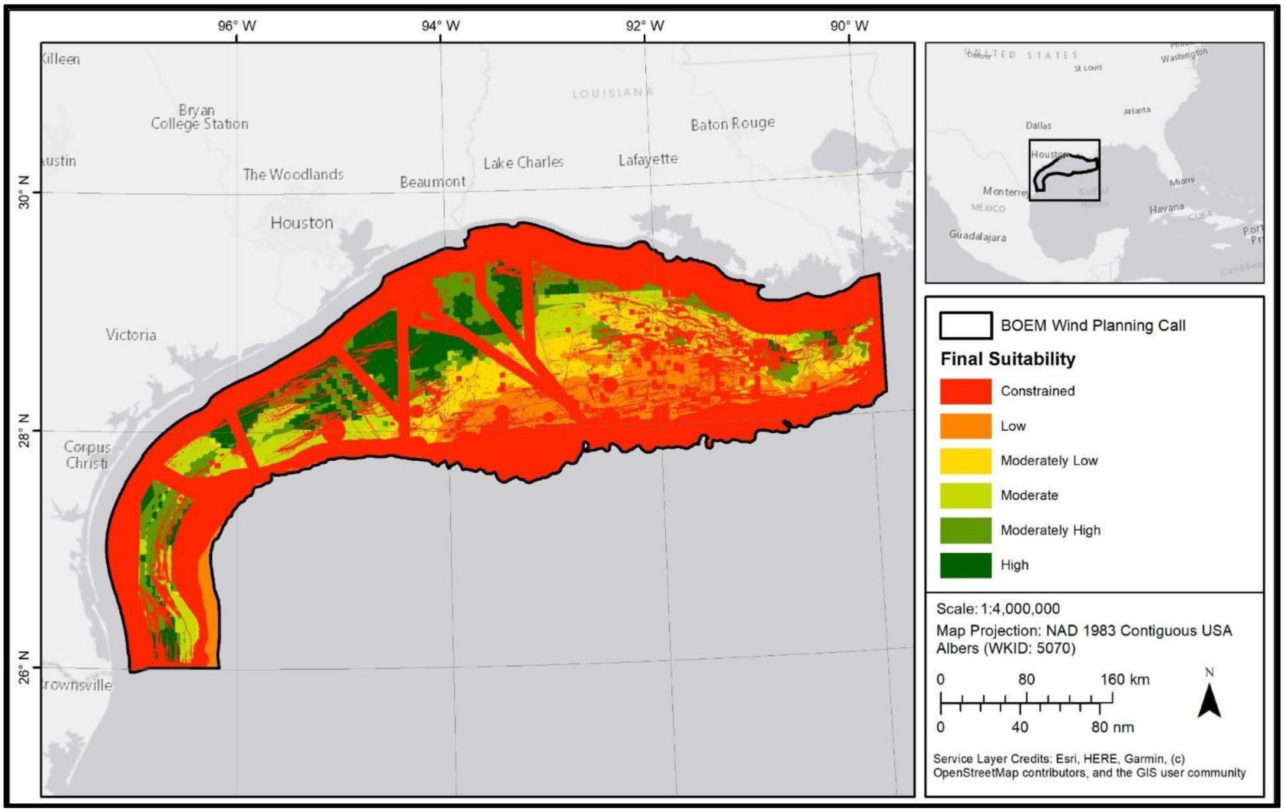


Figure 9: Final suitability modeling results for the Call Area. Red color indicates those areas where layers with a score of 0 occurred due to conflict with ocean activity. Green color indicates areas of highest suitability for offshore wind development.

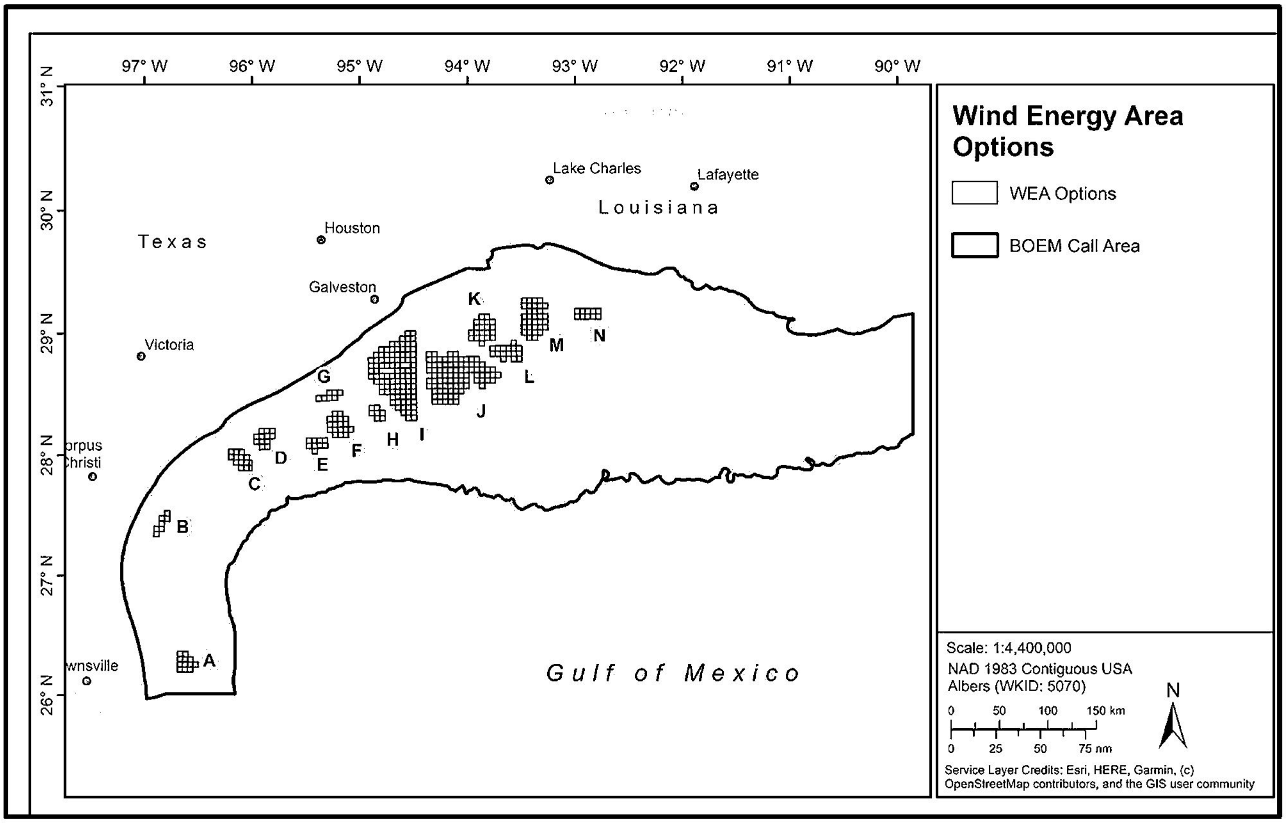


Figure 10: 13 WEA Options from the model Output. Area B is no longer an option due to a later DoD assessment requesting its removal.

D. Environmental Review

BOEM is preparing a programmatic GOM Environmental Assessment (EA) pursuant to NEPA which will be completed before the first GOM OCS wind energy lease sale. The analysis provided in the GOM EA can be used for the issuance of up to 18 OCS wind energy leases and will consider the potential impacts from activities expected to take place after lease issuance, including site characterization activities (such as biological, geological, geotechnical, and archaeological surveys) and site assessment activities (such as meteorological and oceanographic buoy deployment). The EA also compares the potential impacts of site characterization and site assessment activities to the potential cumulative effects from these activities as well as other past, present, and reasonably foreseeable future activities in the GOM.

BOEM's EA will analyze the entire GOM Call Area rather than the Final WEAs that will be identified through the Area ID process. Although NEPA analysis is not required at the Area ID stage, BOEM decided to prepare an EA prior to the identification of the Draft WEAs as an exercise of agency discretion. This approach not only allows greater flexibility for future identification of WEAs, but also provides NEPA coverage for unsolicited requests for commercial or research projects and grants that could be received in the GOM Call Area. The Call informed the environmental review process by identifying and informing the geographic scope of that environmental analysis for any future OCS wind energy lease sales in the area. If there is an OCS wind energy lease sale in the GOM, the issuance of an OCS wind energy lease would grant the lessee the exclusive right to submit plans for BOEM's review. The issuance of a lease by BOEM does not convey the right to proceed with construction and operation of a wind energy facility. Therefore, BOEM does not consider the issuance of a lease to constitute an irreversible and irretrievable commitment of resources. Before any OCS wind energy lease sale, BOEM will conduct associated consultations to consider the potential impacts from the activities that are reasonably foreseeable to take place after lease issuance. Those activities include site characterization activities (such as biological, geological, geotechnical, and archaeological surveys) and site assessment activities (such as meteorological and oceanographic buoy deployment).

The EA will incorporate pertinent supporting material in appendices from studies sponsored by BOEM, as well as other government and academic institutions; consultation documents; and other peer-reviewed literature. Once the draft EA is completed, a notice to stakeholders will be issued by BOEM, along with a 30-day public comment period. During the public comment period, BOEM will host virtual meetings, provide information on the project website, and solicit public input on the EA. If BOEM publishes a Proposed Sale Notice (PSN), comments received on the PSN would also be considered and incorporated into the NEPA process (considered in the Final EA), as applicable.

BOEM is also conducting environmental consultations with relevant Federal and State agencies and Nationally recognized Tribes in advance of the first GOM wind auction. The EA and associated consultations might also identify potential lease stipulations or conditions of plan approval to reduce or eliminate potential environmental impacts associated with site characterization and site assessment activities. The EA will analyze the impacts to resources both with the application of potential protective measures and without protective measures to assist the decisionmaker in choosing the applicable protective measures to apply as lease stipulations or conditions of plan approval. The chosen protective measures would be identified in the Finding of No Significant Impact and detailed in the Final Sale Notice (FSN), should BOEM publish a FSN.

If an OCS wind energy lease is issued and a lessee submits a COP proposing development activities on that lease, BOEM would consider its merits; perform the necessary consultations with the appropriate State, Federal, local, and Tribal entities; solicit input from the public and Task Force members; and perform an independent, comprehensive, environmental analysis under NEPA. This separate environmental analysis for a COP would provide additional opportunities for public involvement pursuant to NEPA and the Council on Environmental Quality regulations at 40 CFR Parts 1500–1508. BOEM would use this information to evaluate the potential environmental and socioeconomic impacts associated with the lessee-proposed project, and potential cumulative effects from these activities as well as other past, present, and reasonably foreseeable future actions, when considering whether to approve, approve with modification, or disapprove a lessee's COP pursuant to 30 CFR 585.628.

E. Proposed and Final Sale Notices

If BOEM decides to offer an area(s) for lease, BOEM would publish a PSN describing the proposed area(s) for competitive leasing, the associated terms and conditions, and a proposed format of the competitive auction issued pursuant to 30 C.F.R. § 585.216. The PSN would be followed by a 60-day formal comment period, which helps to inform the FSN. BOEM may use information from the NEPA analysis for any lease sale, as well as information gathered in response to the PSN, to further refine lease areas and develop lease terms and conditions.

V. Background

A. Gulf of Mexico: General Description

The present-day GOM is an ocean basin with a water-surface area of more than 1.5 million square kilometers (km^2) (371 million acres). The greatest water depth is approximately 3,700 meters (m) (roughly 12,000 feet [ft]). It is almost completely surrounded by land, opening to the Atlantic Ocean through the Straits of Florida and to the Caribbean Sea through the Yucatan Channel. The northern GOM may be divided into several physiographic sub-provinces. In the OCS area, these include the Texas-Louisiana Shelf, Texas-Louisiana Slope, Rio Grande Slope, Mississippi Fan, Sigsbee Escarpment, Sigsbee Plain, Mississippi-Alabama-Florida Shelf, Mississippi-Alabama-Florida Slope, Florida Terrace, Florida Escarpment, and Florida Plain (Figure 11). In the GOM, the continental shelf extends seaward from the shoreline to about the 200-m (656-ft) water depth and is characterized by a gentle slope of a few meters per kilometer (less than 1 degree). The shelf is wide off Florida and Texas, but it is narrower where the Mississippi River delta has extended seawards to near the shelf edge. The continental slope extends from the shelf edge to the Sigsbee and Florida Escarpments in about 2,000- to 3,000-m (6,562- to 9,843-ft) water depth. The topography of the slope is irregular and characterized by canyons, troughs, and salt structures. The gradient on the slope is normally 1-2 degrees, while the gradient of the Florida Escarpment may reach 45 degrees in some places. The Mississippi Fan has a gentle incline, with slopes of 4 m (13 ft) or less per kilometer (21 ft or less per mile), with the lower Mississippi Fan having an even flatter slope at 1 m (3 ft) or less per kilometer (5 ft or less per mile). The Sigsbee and Florida abyssal plains (ocean floor) are basically horizontal physiographic sub-provinces and are surrounded by features with higher topography.

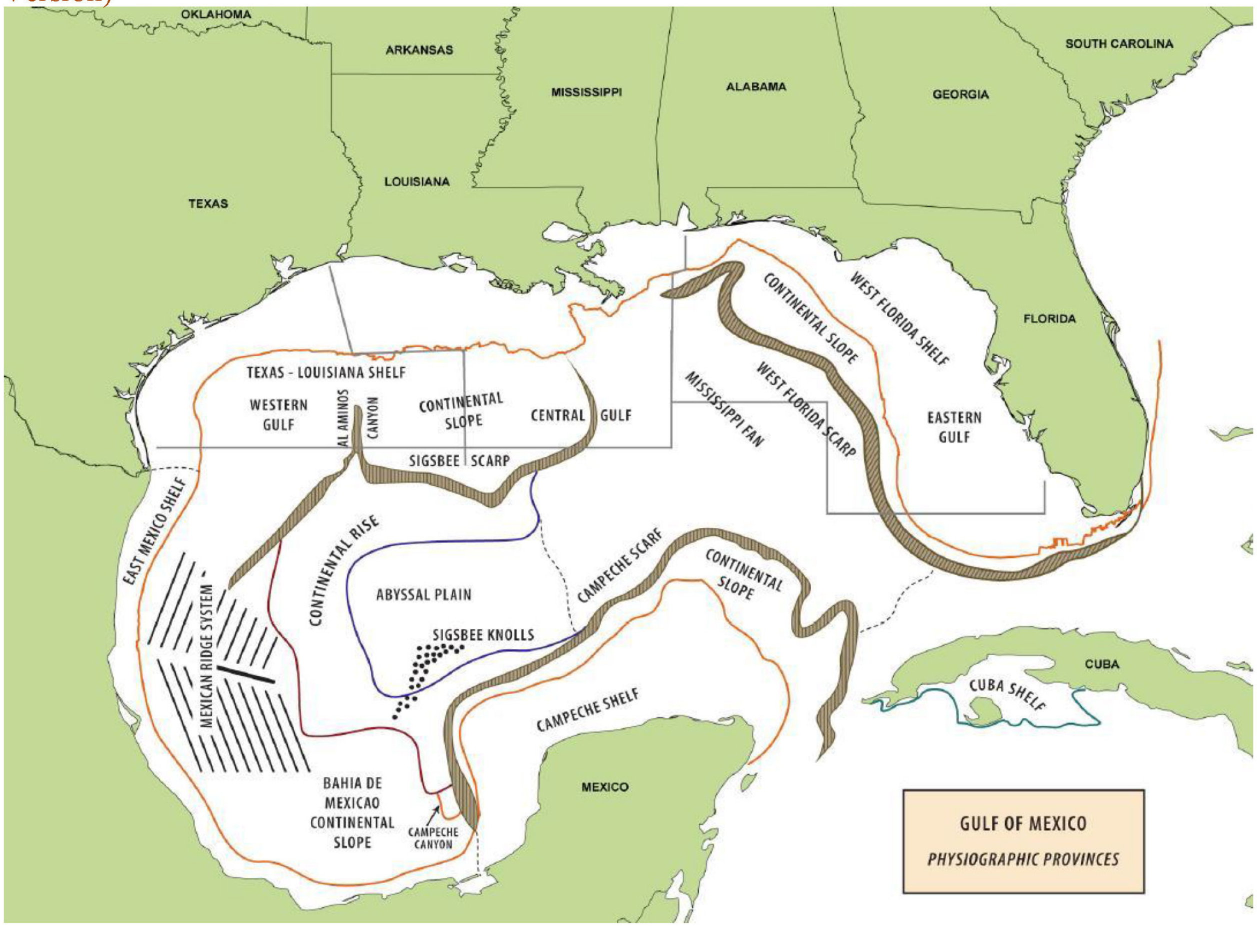


Figure 11: Generalized Physiographic Map of the Gulf of Mexico OCS (Adapted from The Encyclopedia of Earth (2011).

B. Regional State Activities

1. Louisiana

In August 2020, Governor John Bel Edwards signed Executive Order JBE2020-18 to establish a Climate Initiatives Task Force and set greenhouse gas emission reduction goals for the State of Louisiana. On October 21, 2020, the State of Louisiana sent a request to BOEM for the establishment of a Renewable Energy State Task Force. BOEM recognizes the regional nature of ocean uses and renewable energy development on the OCS and the importance of incorporating regional perspectives into the planning process. As such, BOEM responded to the request by establishing a Regional Task Force. The GOM Task Force membership consists of representatives from Federal, State, local, and Tribal governments within Alabama, Louisiana, Mississippi, and Texas.

On February 1, 2022, The Louisiana Climate Initiatives Task Force delivered the state's first ever Climate Action Plan to the Governor. The 2022 Louisiana Climate Action Plan contains a balanced set of recommendations to limit the severity of climate change while positioning the state to maintain its economic competitiveness in a low-carbon future. The science-based plan achieves the Governor's goals of reaching net zero greenhouse gas emissions by 2050. The plan also calls on the state to plan for development of offshore wind and proposes the enactment of an offshore wind generation goal of 5 GW by 2035.

2. Alabama

The State of Alabama is currently gathering information related to offshore wind. The state has been conducting exploratory outreach to key stakeholders, including Alabama State Port Authority, Alabama Department of Environmental Management, Baldwin and Mobile Counties, Public Service Commission, energy utilities, and environmental groups to understand concerns, potential impacts, and industrial synergies related to offshore wind energy.

3. Mississippi

Currently, the State of Mississippi has not yet established any offshore wind renewable energy goals.

4. Texas

Currently, the State of Texas has not yet established any offshore wind renewable energy goals.

C. Nominations

In response to the Gulf of Mexico RFI and Call, BOEM received 10 nominations from entities proposing to develop offshore wind within the GOM Call Areas, as shown in Figure 12. Submitting the nominations were:

1. East Wind-EnBW, LLC
2. Enterprize Energy USA, LLC
3. Avangrid Renewables, LLC
4. Hecate Energy, LLC
5. OW North America, LLC
6. Shell New Energies US, LLC
7. Bayou Renewables, LLC
8. Hy Stor Energy LP
9. Mainstream Renewable Power, Inc.
10. 547 Energy LLC

Several developers noted in their submissions that, while they were nominating a specific area, they would be interested in any area that BOEM were to lease in the GOM.

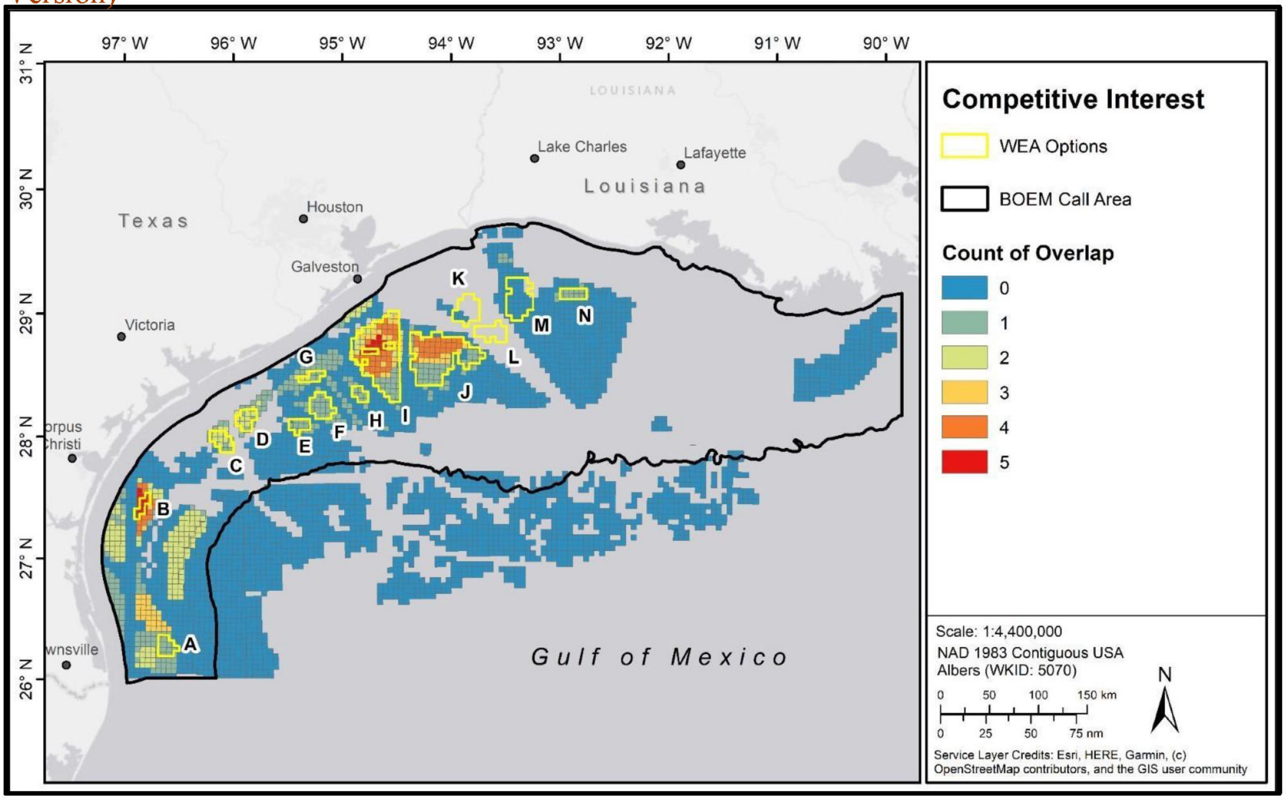


Figure 12: GOM Nominations Received in Response to the RFI and the Call.

D. Competing Uses Analyzed During the Area ID Process

BOEM considered multiple existing uses of the GOM in developing the Preliminary WEAs and identified several potential conflicts between offshore wind development and existing uses. The uses that were found to interact with potential offshore wind development offshore the GOM are (i) commercial and recreational fishing, (ii) maritime navigation, (iii) existing infrastructure, and (iv) DoD activities. Several additional uses and potential impacts were considered and are discussed below (including migratory birds, marine mammal species, and protected resources).

1. Commercial and Recreational Fishing

During the WEA identification process, BOEM considered ways to minimize space-use conflicts between future offshore wind developments and commercial and recreational fisheries operating within and adjacent to the Call Area. The major commercial fisheries operating within and adjacent to the Call Area include the commercial shrimp, reef fish, pelagic longline, coastal migratory pelagic, and Gulf menhaden fisheries. Recreational fisheries can generally be separated into those targeting reef fish and pelagic/highly migratory species.

Both recreational and commercial fisheries data were included in the fisheries submodel (Section C). The commercial penaeid shrimp fishery data used in this analysis for the period of 2015-2019 had the largest overlap with the Call Area at 68.4%, especially in areas closer to shore. The moderate, moderate/high, and high effort data categories were included in the constraints model. The moderate low and low effort data was placed in the suitability model and analyzed using the Z membership function. After consultation with the Southern Shrimp Alliance, the 2015-2019 commercial shrimp dataset was used because these years had the most comprehensive and complete data sets. The menhaden fishery had 5.6% overlap with the Call Area and was predominantly present off the coast of Louisiana. Highly Migratory Species Pelagic Longline Gear Fishing for the period 2011-2020 had extremely low overlap of only 0.6% and is located primarily in deeper waters in the GOM. Both bandit gear fishing and longline gear fishing for reef fish for the period of 2007-2021 had similar amounts of overlap with the study area with the longline gear occurring in deeper waters than the bandit gear fishing. The only recreational fishing data included was the Southeast Region Headboat Survey (SRHS) for the period of 2014-2020 trips, which identified the highest area used by headboat fishing off the coast of Corpus Christi, Texas (TX). In Figure 13, the green areas indicate lower fishing effort which makes the area more suitable for offshore wind.

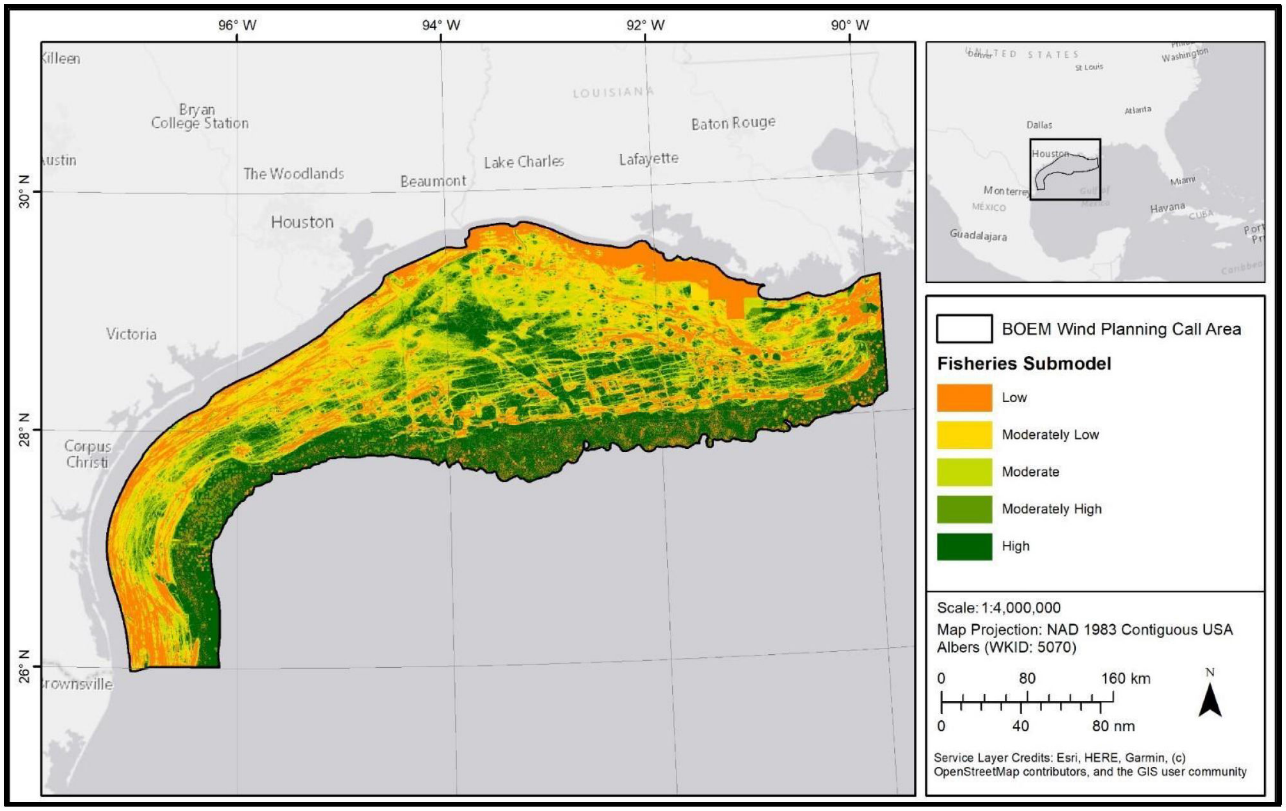


Figure 13: Fisheries submodel used in the ocean planning model. The color orange represents areas of lower suitability with offshore wind energy development, while the color green indicates areas of higher suitability for offshore wind energy development.

The model also factored in fishing vessel transit routes based on 2019 Automatic Identification System (AIS) data to understand potential impacts to fisheries access. Transit counts from fishing vessels with AIS transponders in 2019 indicate 53.5% intersection with the Call Area (Figure 14). The red areas indicate higher fishing vessel traffic. More information on vessel transit routes is presented in the Maritime Navigation section.

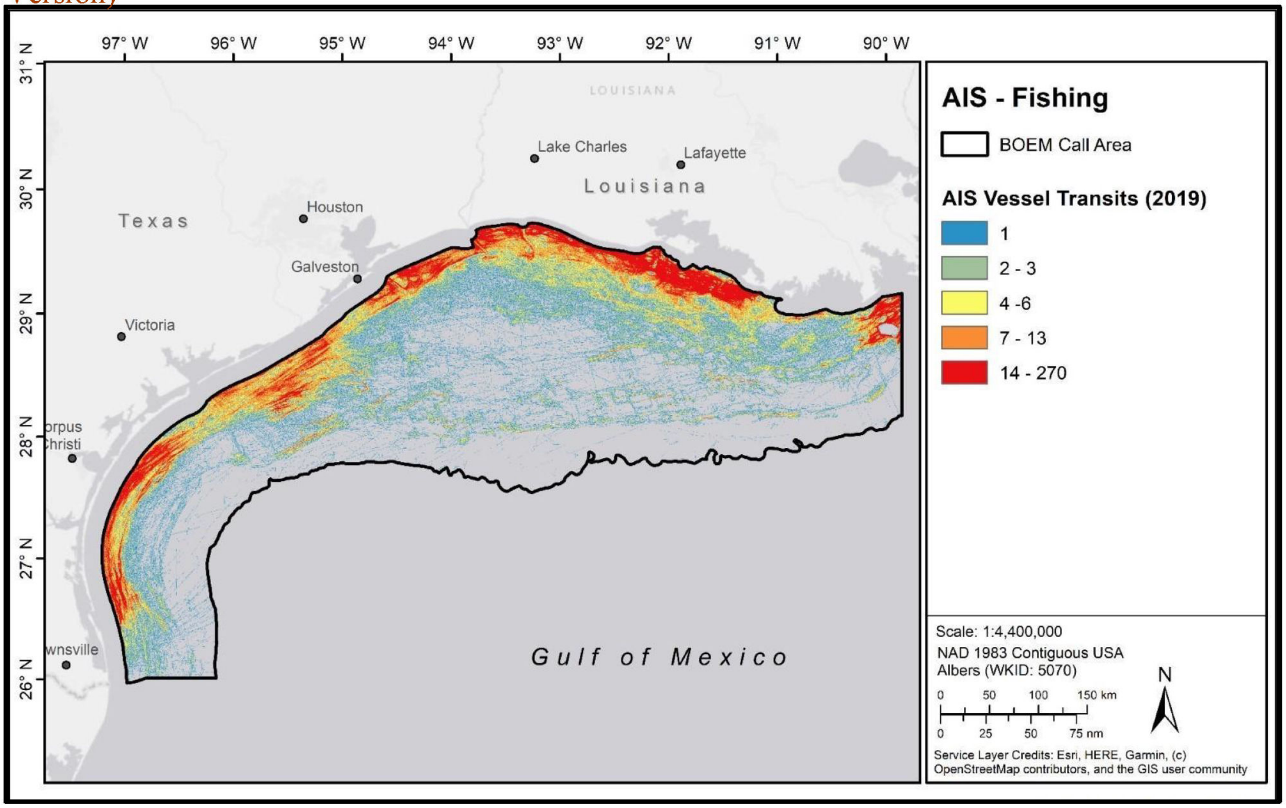


Figure 14: Automatic Identification System Vessel transit data from 2019 for fishing vessels in the Call Area.

While BOEM does not explicitly preclude fishing within a potential wind farm, BOEM recognizes that offshore wind developments could impact certain fisheries, particularly those using techniques that require large areas to operate (e.g., commercial shrimp and Gulf menhaden). To minimize space-use conflicts, BOEM conducted extensive outreach efforts with the GOM fishing community in the form of small, targeted meetings with fishermen's organizations that represent large constituencies, as well as a series of four, sector-specific fisheries workshops held January 19-20, 2022. For more information on the GOM fisheries workshops, go to https://www.boem.gov/renewable-energy/state-activities/gulf-mexico-fisheries-summit.

Information collected during the outreach efforts helped BOEM to identify and address potential space-use conflicts in the Call Area. For example, commercial shrimp industry stakeholders raised concerns during the meetings about displacement of the shrimp fishery in areas of moderate to high shrimp fishing grounds. After review of the comprehensive 2015-2019 Shrimp Electronic Logbook Dataset, BOEM noted that most of the high shrimping areas were within the 20 nm coastline buffer. The remaining high shrimping effort areas were near existing oil and gas infrastructure, and those areas were not further considered in the model due to the proximity to active pipelines and platforms. With most of the moderate to high shrimp fishing grounds located in the 20 nm coastline buffer that was requested by the menhaden fisheries and FWS for migratory birds, BOEM has currently decided to exclude the red areas of moderate to high shrimping effort from consideration during the Area ID process at this time (Figure 15). BOEM also received concerns from the Gulf Menhaden fishery. The Gulf menhaden fishery raised safety concerns with their spotter planes. The spotter planes are used within the 20 nm area from the coastline and can fly as low as 500 ft above sea level. At this time, BOEM has currently decided to not consider areas within 20-nm of the coast from offshore wind development.

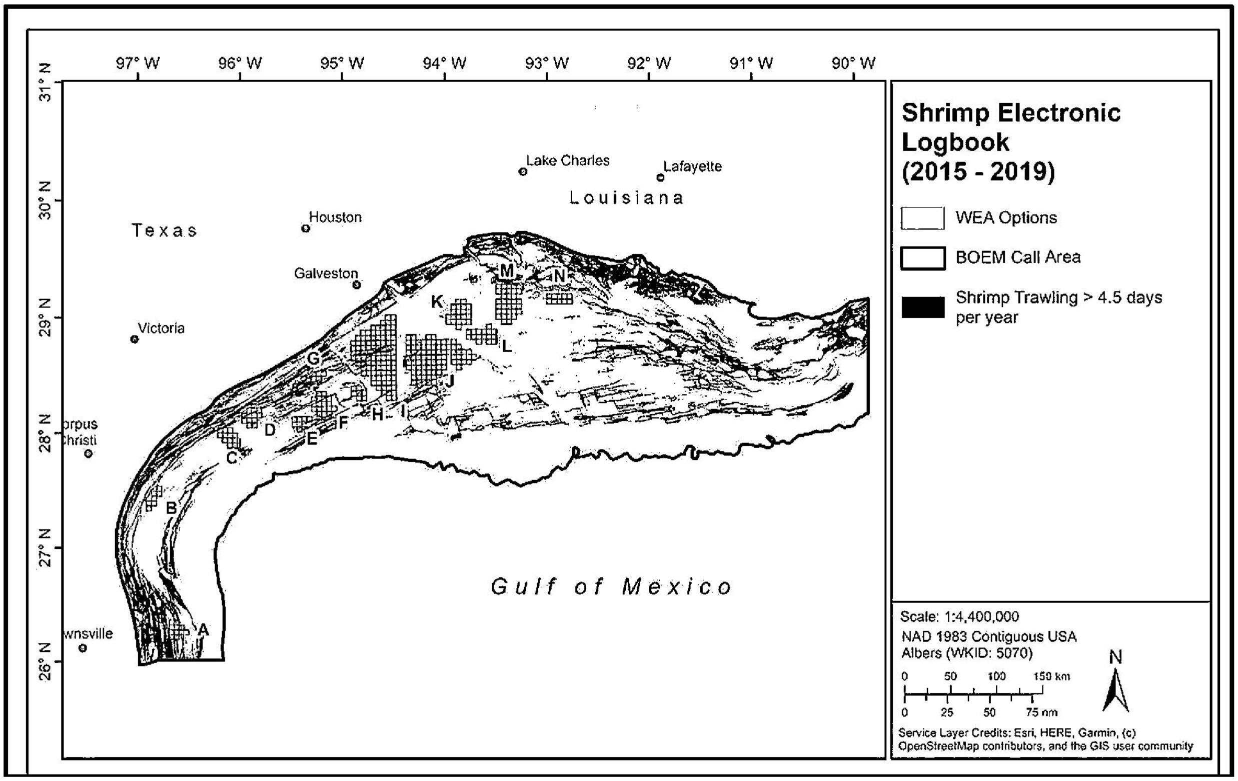


Figure 15: Mean days of shrimp trawling >4.5 days (2015-2019) in relation to the WEA options.

2. *Maritime Navigation*

Commercial vessels 65 feet or greater in length are required to carry AIS transponders. BOEM conducted a review of 2019 (AIS) vessel information. BOEM analyzed the AIS track line and density data within the Call Area to determine historic vessel usage patterns and identify how they may conflict with potential offshore wind energy development. BOEM shared the findings with the USCG and sought their comments. Three main areas of concern emerged: the navigational complexity for deep draft vessels within the traffic lanes due to the smaller traffic lanes in the GOM, larger vessels entering or exiting traffic lanes, and tug and towing vessels crossing the Call Area. BOEM also considered vessel transit, using AIS and Shrimp Logbook data.

Cargo and tanker vessel transits disperse from land-based ports in the Houston/Galveston, TX area with additional dense traffic dispersing from Cameron, Louisiana, and Freeport, Port Arthur, Matagorda, Corpus Christi, and Brownsville, TX. Cargo transits intersected with 23.3% of the Call Area, while tanker transits intersected with 27.2% (Figures 16-17). Dense traffic for cargo and tanker vessels (larger vessels) is largely confined to shipping fairways within the Call Area, with some deviations of vessels, especially of tanker vessels. Tug and tow vessels tend to occur inshore around major ports or working around the shipping fairways as tenders. Tug and tow overlapped 31.6% of the Call Area, mostly in areas closest to land-based infrastructure associated with ports in Louisiana and Texas. Passenger vessels intersected with 49.0% of the Call Area. Pleasure and sailing vessel transits were relatively low with 8.5% overlap. Transit counts from fishing vessels with AIS transponders in 2019 indicate 53.5% intersection with the Call Area (Figure 8 above). Transits by the other category of AIS vessels, which includes several different craft types, are the most widely dispersed in the Call Area with 66.4% overlap. Suitability results for the transit vessel data were analyzed with the Z membership function. The suitability results for the industry and operations submodel, which includes cargo and vessel traffic, are presented in Figure 18. The color orange represents areas of lower suitability with offshore wind energy development, while the color green indicates areas of higher suitability with offshore wind energy development.

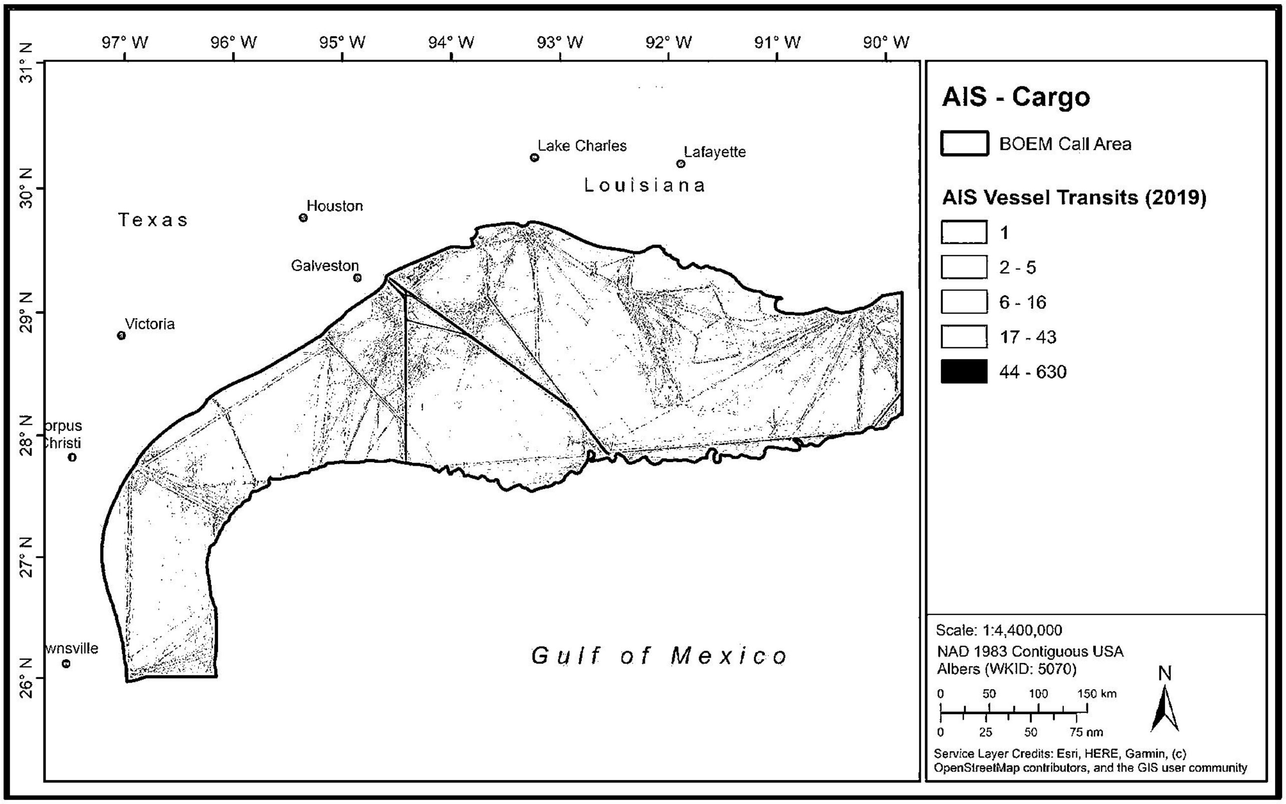


Figure 16: Automatic Identification System Vessel transit data from 2019 for cargo vessels in the Call Area.

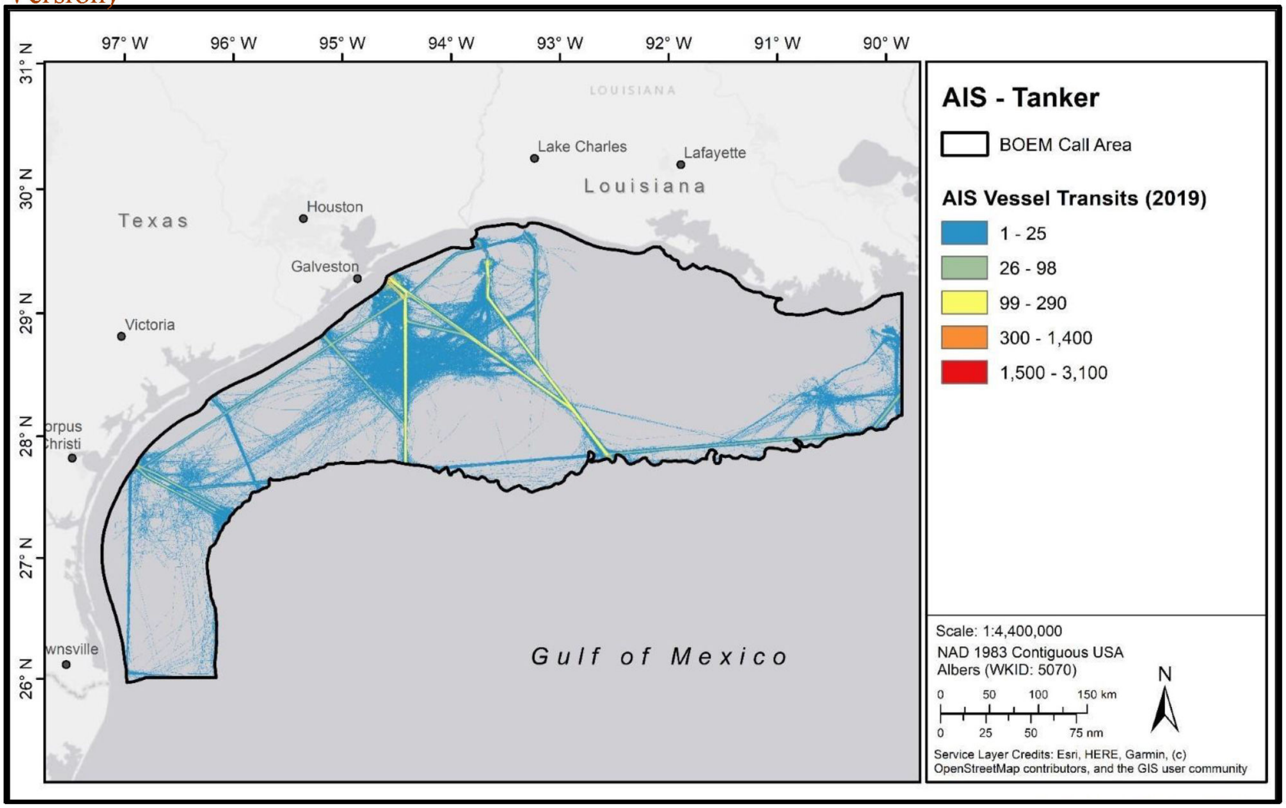


Figure 17: Automatic Identification System Vessel transit data from 2019 for tanker vessels in the Call Area.

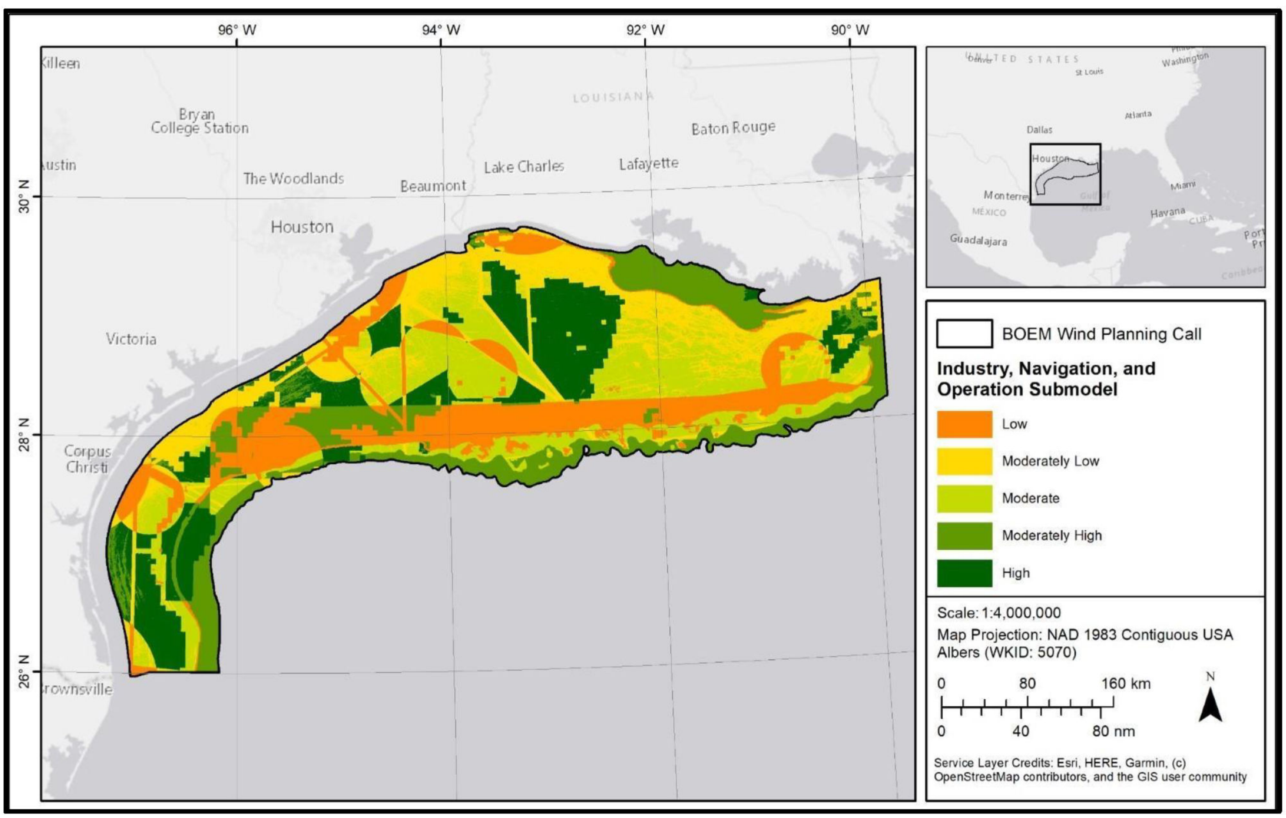


Figure 18: Industry and operations submodel used in the relative suitability model. The color orange represents areas of lower suitability, while the color green indicates areas of higher suitability.

BOEM has held bi-weekly meetings with the USCG since February 2022. The USCG has raised the possibility of adding a 2 nm buffer to the existing fairways due to the smaller vessel traffic lanes in the GOM. The USCG has submitted a proposed fairway anchorage area off Sabine Pass, Texas (Figure 19). BOEM acknowledges additional deconflicting with the maritime community may be necessary prior to establishing final WEAs and plans to continue to consult with the USCG prior to publishing lease areas in the PSN.

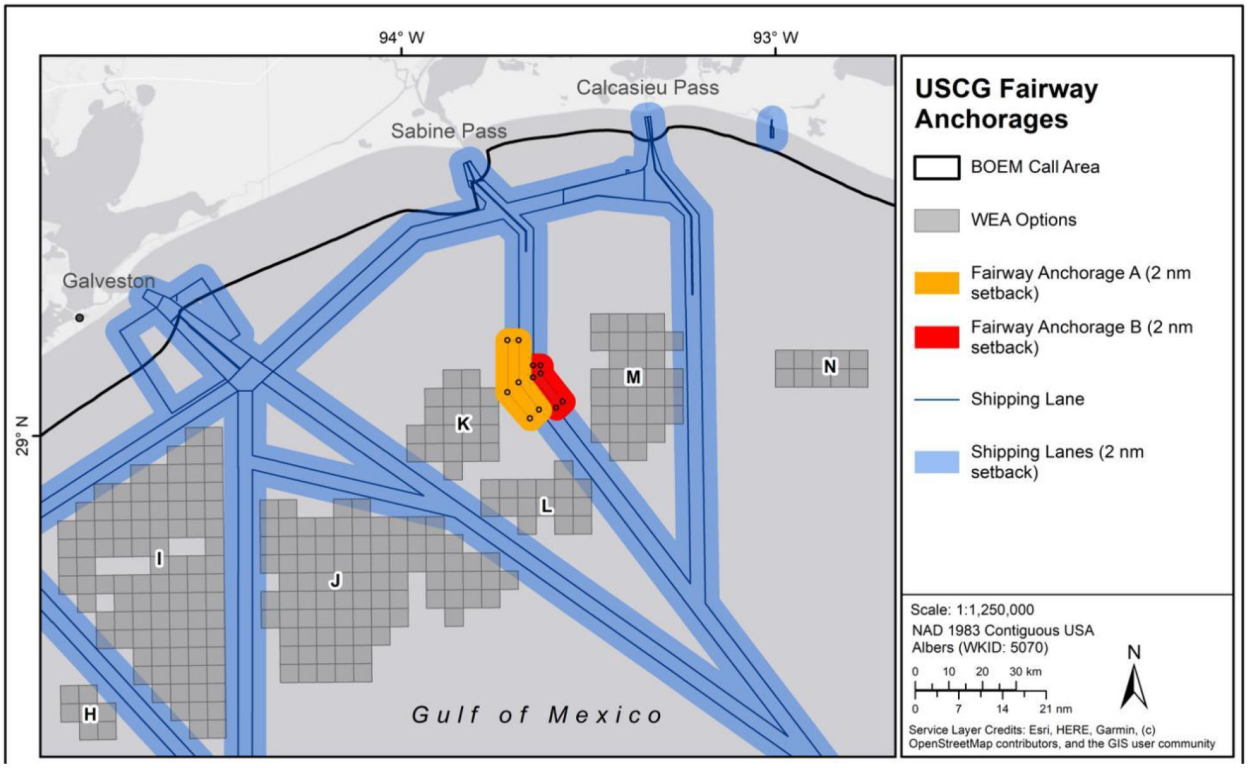


Figure 19: USCG Fairway Anchorages in relation to the WEA options.

3. *Department of Defense*

As a part of BOEM's ongoing coordination with DoD, the Military Aviation and Installation Assurance Siting Clearinghouse Office coordinated within the DoD a review of the GOM Call Area. On May 9, 2022, DoD provided a draft assessment, illustrated in Figure 20. DoD identified a portion of the GOM Call Area as a "Wind Exclusion Area" due to the potential conflict with the low-altitude training by the Department of Navy-Training Air Wing Two, based out of Naval Air Station in Kingsville, Texas, in Warning Area W-228A, and Military Training Route VR-151. The area of overlap between the DoD Wind Exclusion areas and the Call Areas has been removed from the Recommended Preliminary WEAs to reduce this conflict.

The BOEM areas labeled PS (South Padre Island), PN (North Padre Island), MU (Mustang Island), MI (Matagorda Island) and northern areas of GA (Galveston), HI (High Island), WC (West Cameron Area), EC (East Cameron Area), VR (Vermillion Area), and SM (South Marsh Island Area) in Figure 21, lie within radar line of sight of multiple North American Aerospace

Defense Command (NORAD) radar sites and may adversely impact NORAD operations. The potential adverse impacts are mitigatable through Radar Adverse-impact Management (RAM). For projects where the RAM mitigation is acceptable, BOEM will include the project approval conditions in any lease sale notification.

No major impacts to current Air Force missions were identified, however, many of the blocks of interest in the Call Area for wind turbines lie within Military Warning Area Airspace. Wind turbines can affect radar returns, which could result in impacts to DoD aircraft operations within this airspace. Radar interference from the turbines remains a concern with DoD and may require future evaluation.

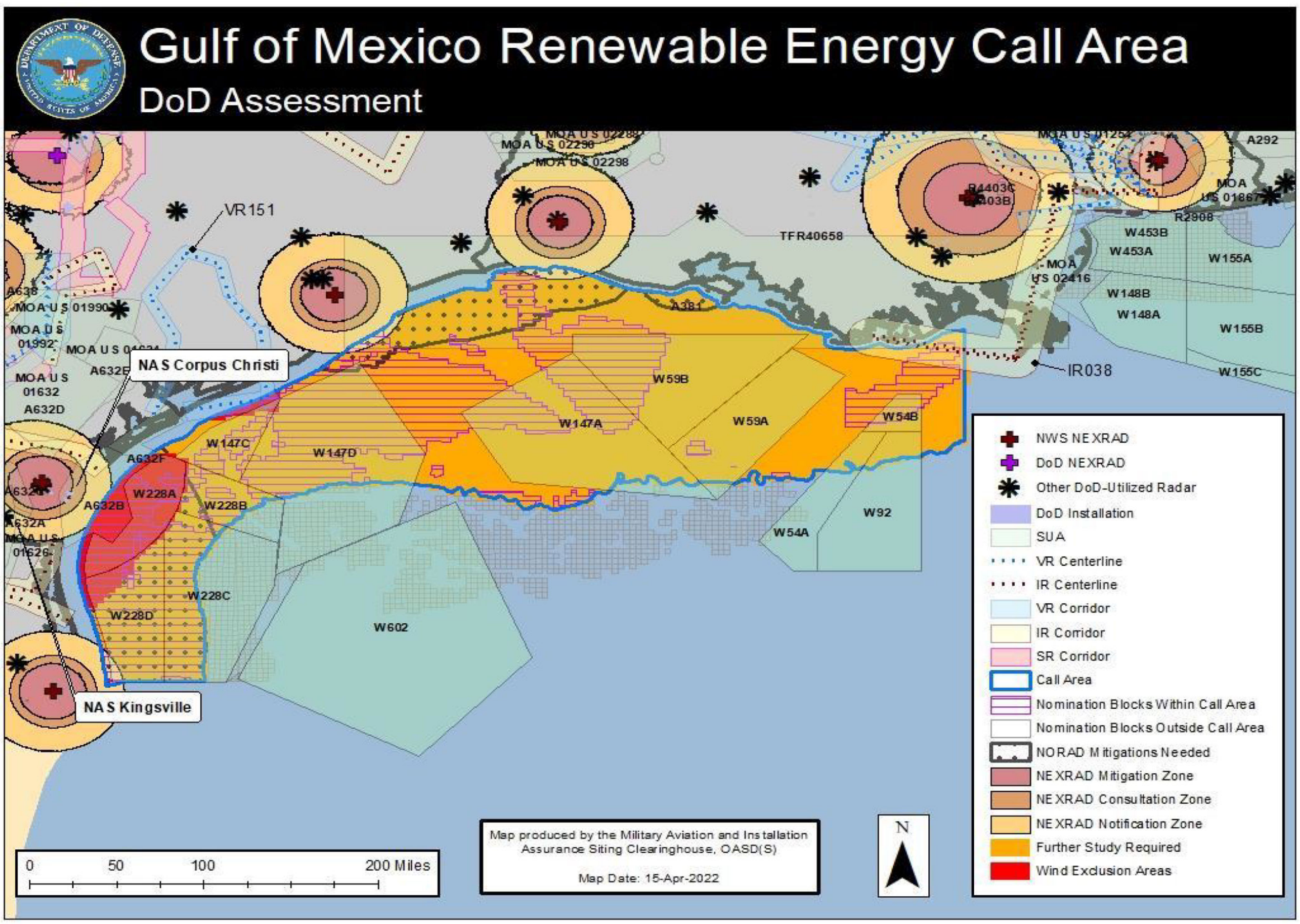


Figure 20: Preliminary DoD Offshore Wind Compatibility Assessment presented to BOEM on May 9, 2022.

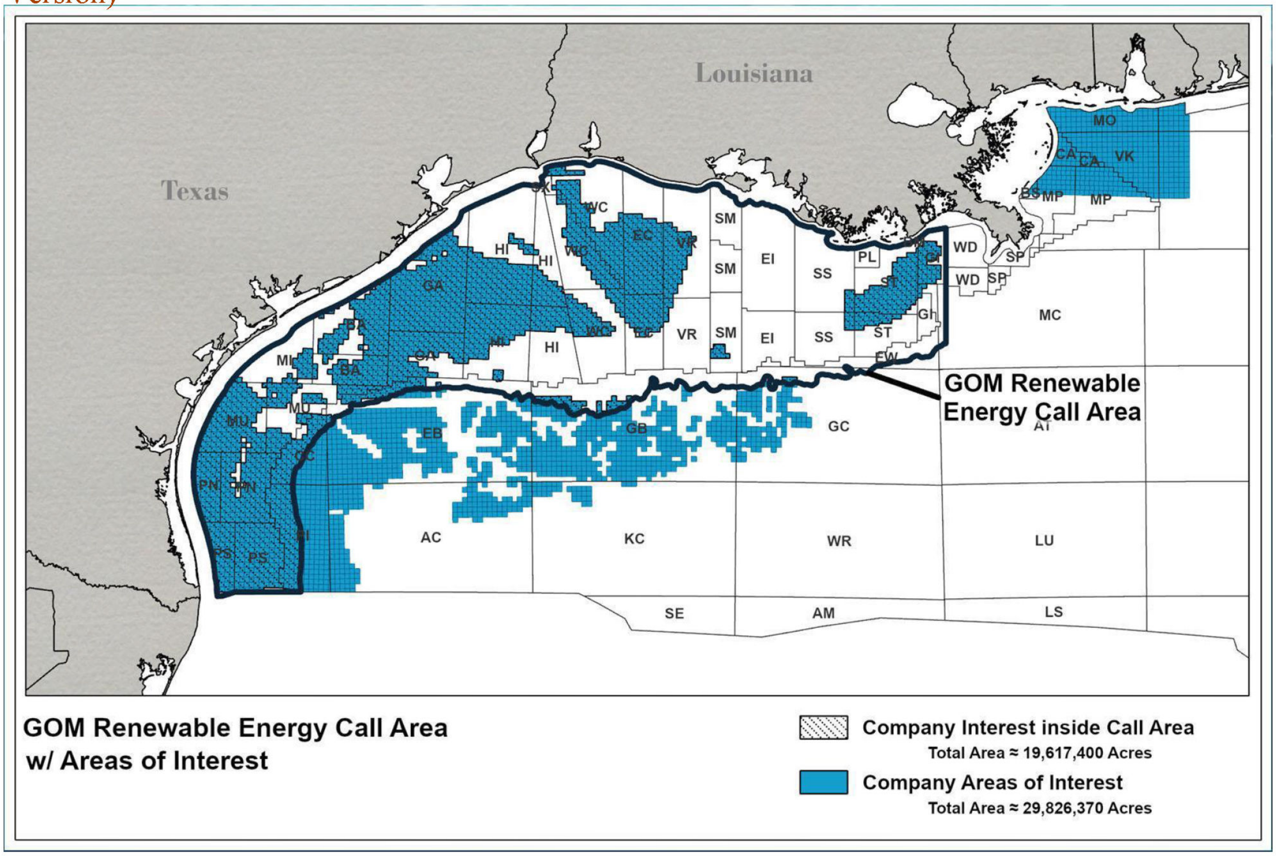


Figure 21: BOEM Generated Gulf of Mexico Renewable Energy Call Area Map with areas nominated by wind developers during the RFI and Call.

4. *Avian Species*

During the outreach meetings and in the comments received in response to the Call, FWS and other stakeholders raised concerns about migratory birds and migratory bird flight paths in the GOM. The GOM includes three of the four North American Flyways for migratory birds. As a result, FWS recommended a 20 nm coastline buffer to mitigate potential impacts to migratory birds in the GOM. After careful review of the cited literature and recommendations, BOEM has currently added a 20 nm coastline buffer to the constraints model in the ocean planning model to eliminate those areas from further consideration in the Area ID process at this time (Figure 22).

In the Natural and Cultural Resource submodel, BOEM added a 24 pelagic seabird species data layer to the submodel to create a combined pelagic seabird suitability layer. The 24 seabird species include: Audubon's Shearwater, Black-capped Petrel, Black Tern, Bonaparte's Gull, Brown Booby, Brown Noddy, Brown Pelican, Bridled Tern, Band-rumped Storm-Petrel, Cory's Shearwater, Common Loon, Common Tern, Great Shearwater, Herring Gull, Laughing Gull, Masked Booby, Magnificent Frigatebird, Northern Gannet, Parasitic Jaeger, Royal Tern, Sandwich Tern, Sooty Tern, Wilson's Storm-Petrel, and Pomarine Jaeger. In Figure 23, the areas of orange/yellow are less suitable for offshore wind development due to their suitability for the pelagic birds. The blue areas are more suitable for offshore wind development. As a result of the data, the ocean planning model avoided the orange/yellow areas that were less suitable with offshore wind (Figure 23).

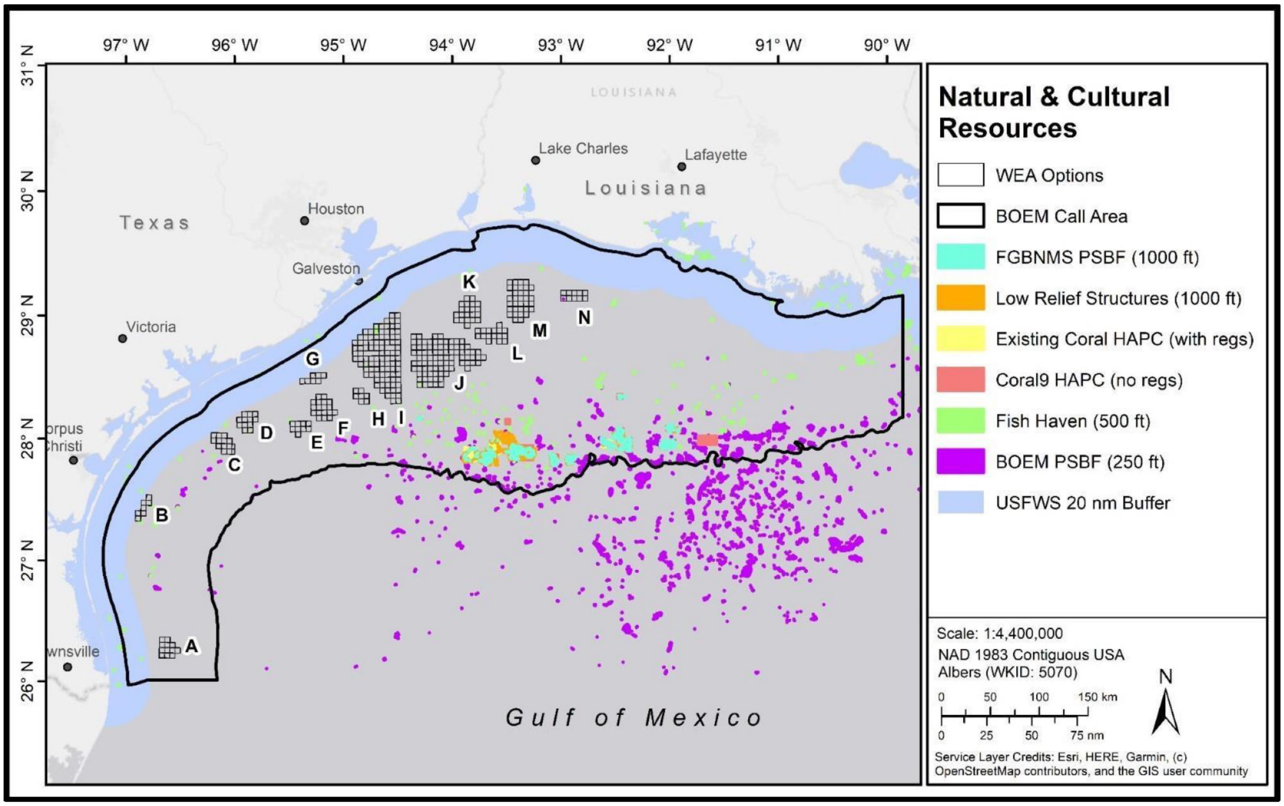


Figure 22: Natural and Cultural resource considerations in relation to the WEA options. The light blue area represents the recommended 20 nm buffer by USFWS.

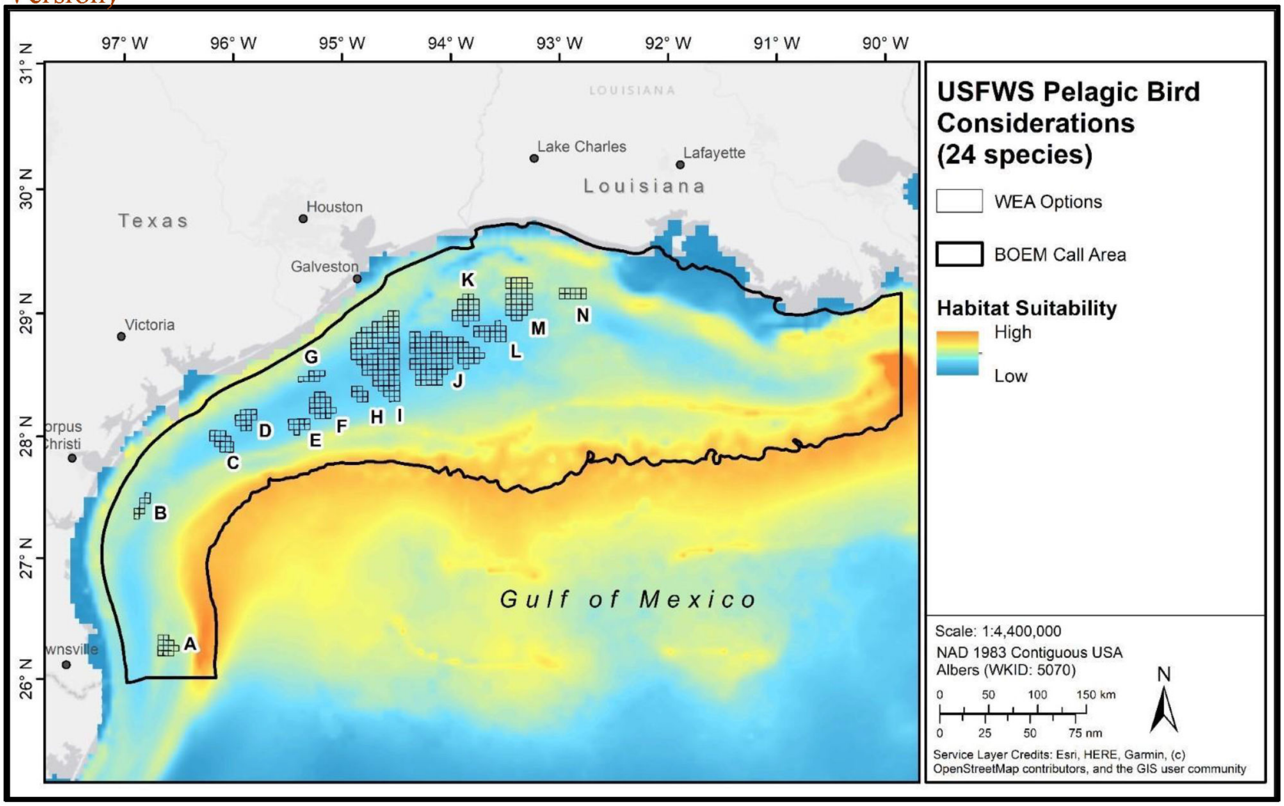


Figure 23: USFWS GoMMAPPS pelagic seabird (24 species) combined habitat suitability layer in relation to the WEA options. The orange/yellow areas represent high habitat suitability for birds therefore, less suitability for offshore wind development. The blue areas represent low habitat suitability for birds. These areas are more suitable for offshore wind development.

5. *Marine Mammals and other Protected Species*

To holistically consider protected species in the GOM region, a novel combined data layer used in calculating the overall score for select protected species was developed through collaboration with NMFS Southeast Regional Office (SERO) and NMFS Office of Protected Resources. A total of 23 protected resource data layers were combined and used in the suitability model as a single NMFS protected resources layer. The combined layer was place in the Natural and Cultural submodel.

Protected species considered include those listed under the Endangered Species Act (ESA) and/or protected under the Marine Mammal Protection Act (MMPA). This approach was preferred given that this ocean planning process does not consider gear-specific wind planning or other secondary interactions with protected species. This combined data layer contains only highly vulnerable protected species. As a result, a number of protected species, including some marine mammals, were excluded from this analysis. The Rice's whale 100-400 m data layer was included in the constraints model and assigned a score of 0 for complete avoidance.

Scores were assigned to each species based on species' status, population size, and trajectory. The scores in Table 9 for MMPA, and ESA-listed species range from 0.1 (most vulnerable species, based on their biological status) to 0.8 (least vulnerable species) were provided using best available data for the Call Area. This scoring approach was developed for each species/stock using factors that are more or less likely to affect their ability to withstand mortality, serious injury, or other impacts that could affect the species' ability to survive and recover.

Table 9: Scoring system for NMFS protected resources

Status	Trend	Score
Endangered	Declining, small population* or both	0.10
Endangered	Stable or unknown	0.20
Endangered	Increasing	0.30
Threatened	Declining or unknown	0.40
Threatened	Stable or increasing	0.50
MMPA Strategic	Declining or unknown	0.60
MMPA Listed	Small population* or unknown/declining	0.70
MMPA Listed	Large population or stable/increasing	0.80

*Small population equates to populations of 500 individuals or less (Franklin 1960)

A total of 23 data layers including Atlantic spotted dolphin (coastal), Atlantic spotted dolphin (oceanic), Beaked whale, Bottlenose dolphin (coastal), Bottlenose dolphin (oceanic), Clymene dolphin, Blackfish (False killer, Pygmy killer, and Melon-headed whales), Giant manta ray, Green sea turtle, Gulf sturgeon, Hawksbill sea turtle, Kemp's ridley sea turtle, Kogia (Dwarf and Pygmy sperm whale), Leatherback sea turtle, Loggerhead sea turtle, Oceanic whitetip shark, Pantropical spotted dolphin, Pilot whale, Rice's whale, Smalltooth sawfish (U.S. DPS), Sperm whale, Spinner dolphin, and Striped dolphin were combined into a single data layer using the product method, which provides the highest weight to the lowest score. Table 10 provides each species' status and trend, as well as the score used when creating the combined data layer for use within the relative suitability model. The combined data layer provides the highest resolution and contrast allowing for meaningful comparisons between grid cells, and correctly attributing increasing levels of concern for areas with multiple overlapping protected species data layers (Figure 24).

Table 10: Score and justification for ESA-listed and MMPA species known to occur within the Gulf of Mexico used in suitability modeling.

Species Common Name	Status and Trend	Score
Atlantic spotted dolphin (coastal)	MMPA Listed, unknown	0.7
Atlantic spotted dolphin (oceanic)	MMPA Listed, large population	0.8
Beaked whale	MMPA Listed, unknown	0.7
Bottlenose dolphin (coastal)	MMPA Listed, large population	0.8
Bottlenose dolphin (oceanic)	MMPA Listed, unknown	0.7
Clymene dolphin	MMPA Strategic, unknown	0.6
Blackfish (False killer, Pygmy killer, & Melon-headed whale)	MMPA Listed, unknown	0.7
Giant manta ray	Threatened, declining	0.4
Green sea turtle	Threatened, increasing	0.5
Gulf sturgeon	Threatened, increasing	0.5

Hawksbill sea turtle	Endangered, unknown	0.2
Kemp's ridley sea turtle	Endangered, unknown	0.2
Kogia (Dwarf and Pygmy sperm whale)	MMPA Listed, unknown	0.7
Leatherback sea turtle	Endangered, declining	0.1
Loggerhead sea turtle	Threatened, unknown/stable	0.4
Oceanic whitetip shark	Threatened, unknown/declining	0.4
Pantropical spotted dolphin	MMPA Listed, unknown	0.7
Pilot whale	MMPA Listed, unknown	0.7
Rice's whale	Endangered, small population	0.1
Risso's dolphin	MMPA Listed, unknown	0.7
Smalltooth sawfish (U.S. DPS)	Endangered, increasing	0.3
Sperm whale	Endangered, unknown	0.2
Spinner dolphin	MMPA Strategic, unknown	0.6
Striped dolphin	MMPA Strategic, unknown	0.6

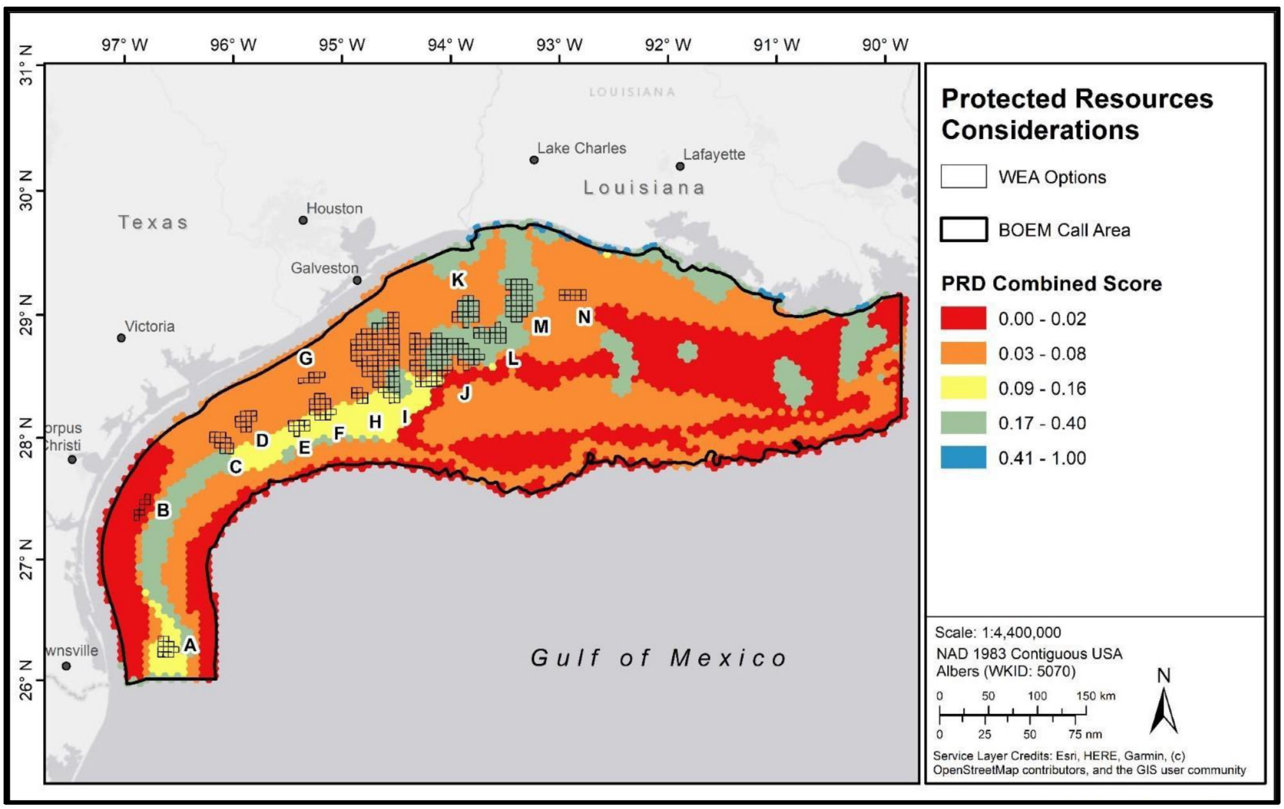


Figure 24: Protected resources considerations in relation to the WEA options.

Through the review of these data on a broad scale, the goal was to avoid designating WEAs in areas where the presence of these protected resources is significant. BOEM will conduct a more detailed analysis during the consultation process to further reduce risk to marine mammals and other protected species for the recommended Galveston Preliminary WEA (Option I). BOEM also determined that site-specific mitigations to impacts on marine protected species would be identified at later stages in the development process, such as through lease stipulations and terms and conditions of COP approval.

a) Cables, Pipelines, and other Infrastructure

The GOM supplies trillions of dollars annually to the national economy via major marine industries (e.g., oil and gas production, commercial seafood, shipping). Given the substantial presence of ocean industries in the region, industry activity in and around the Call Area was spatially examined.

U.S. oil and gas production in the Gulf of Mexico is one of the largest industrial users of regional marine resources. BOEM's active oil and gas lease blocks, platforms (including active drilling structures), oil and gas pipelines (active), and oil and gas boreholes were all assigned a score of 0 and moved to the constraints submodel for analysis. Submarine cables transmit 95% of international communications and approximately ten trillion dollars (USD) in financial transactions each day,[20] therefore, these were considered critical infrastructure and were avoided.

VI. Rationale for Preliminary WEA Recommendation

A. Introduction

To facilitate the Area ID planning process, BOEM prefers to maintain flexibility by identifying more (and some cases, larger) WEAs. In recommending the Galveston and Lake Charles Preliminary WEAs, BOEM is advancing the Biden-Harris Administration's goal to achieve 30 GW of offshore wind by 2030 and net zero emissions by 2050 and aims to be responsive to Louisiana's renewable energy goals, increase the potential for competition in future offshore wind energy solicitations, and develop a predictable leasing pipeline.

BOEM understands that some of the recommended Preliminary WEAs (or portions thereof) may ultimately not be offered as lease areas. BOEM is also aware that some portions of the recommended areas may overlap with commonly used navigation corridors. As described in the navigation section above, the USCG is currently engaging with BOEM to investigate potential navigational measures, such as adding a 2 nm buffer to the existing fairways in the GOM. For the purposes of this effort, BOEM is working closely with the USCG and stakeholders and believes that there is enough space offshore Texas and Louisiana to safely accommodate both offshore renewable energy and maritime traffic aspirations.

BOEM also recognizes that coastal states closest to a lease area are afforded many potential opportunities related to offshore wind industry development, including workforce and supply chain development. Conversely, potential impacts to existing ocean users generally fall most heavily on the state whose coastline is closest to the leased area. The inclusion of these recommended Preliminary WEAs in proximity to both Louisiana and Texas coastlines would facilitate more equitable distribution of the positive and negative offshore wind development externalities.

BOEM's Preliminary WEA recommendations are a result of balancing key existing interests, resources in the GOM, state renewable energy goals, and anticipated future uses based on the best

[20] Tri-Service Strategy. 2020. Advantage at sea: Prevailing with integrated all-domain naval power. Available from: https://media.defense.gov/2020/Dec/16/2002553074/-1/- 1/0/TRISERVICESTRATEGY.PDF

available science and information. Areas offered for lease would be identified in a PSN, as discussed in Section IV. BOEM would consider, in its final leasing decision, the results of the NEPA analysis and associated consultations. Additionally, BOEM maintains its flexibility to offer only a portion of the WEAs for lease, leaving unselected areas for future consideration. This section discusses the rationale for the recommendation of each WEA and, where appropriate, the exclusion of portions of the Call Area that BOEM is not currently recommending for leasing consideration. As different areas had different balancing factors, select area-specific issues are discussed in more detail for specific recommended WEAs below.

B. Galveston Preliminary WEA (Option I)

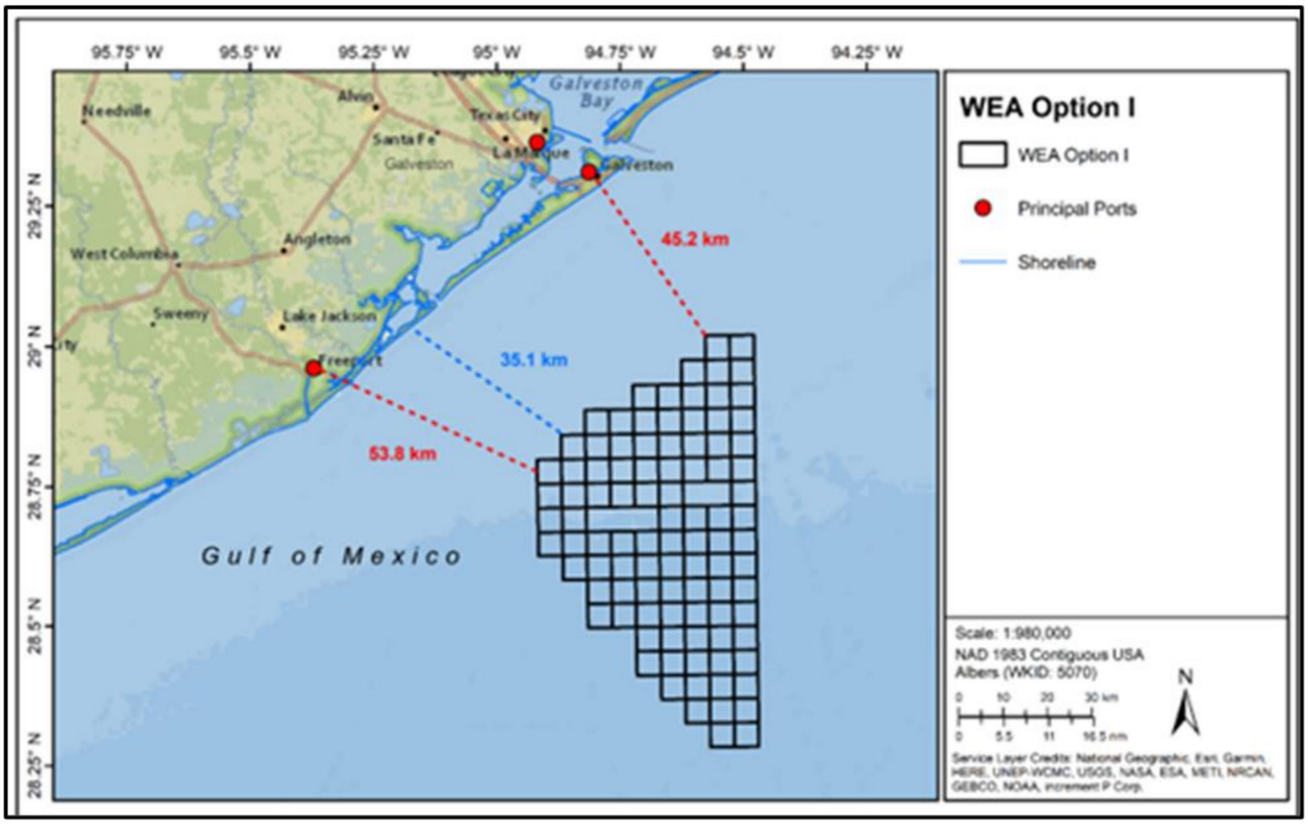


Figure 25: Galveston Preliminary WEA

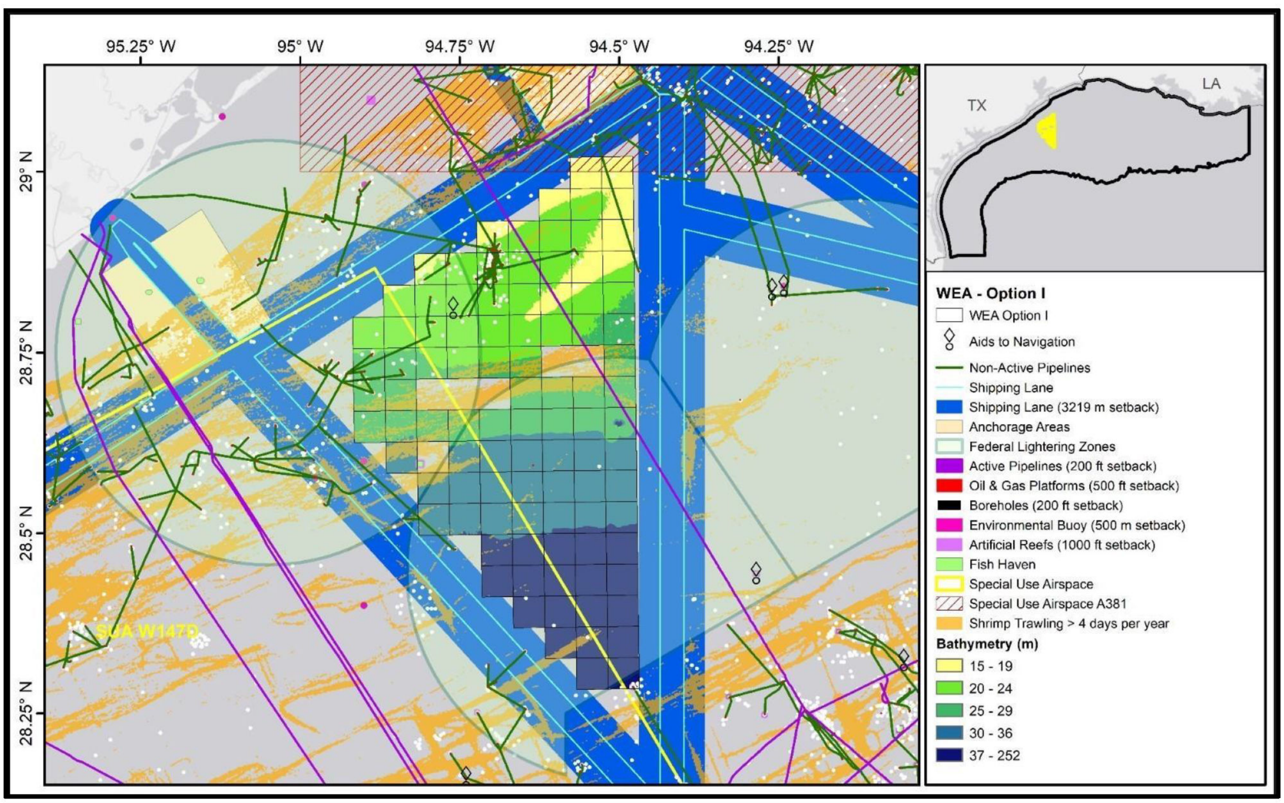
BOEM acknowledges that offshore wind activities in portions of the recommended the Galveston Preliminary WEA could potentially result in conflicts with other uses of these areas. The recommended Galveston Preliminary WEA was chosen by balancing several factors, the most prominent being commercial fisheries, DoD activities, navigation, and commercial viability.

1. Fisheries

The 2019 AIS Tracking Data for fisheries showed relatively high usage in the portion north of the Galveston Preliminary WEA, with fisheries usage decreasing as it approaches the Galveston Preliminary WEA. In comparison with the other WEA options, the Galveston Preliminary WEA scored in the top 3 for most suitable for wind for fisheries with less than ten percent of moderate-high VMS shrimp fishing areas. The two areas with high shrimp trawling were removed from further consideration at this time (Figure 26 depicted in gray).

Fish havens are defined as artificial reefs or "submerged structures deliberately constructed or placed on the seabed to emulate some functions of a natural reef, such as protecting, regenerating, concentrating, and/or enhancing populations of living marine resources."[21, 22] Fish haven boundary data were extracted from the NOAA electronic navigational chart (ENC) using the ENC Direct to GIS tool. The extracted features were quality assured by overlaying the features onto the ENC within ArcGIS Pro and performing manual checks to ensure polygons lined up with those on navigation charts. As recommended by the USACE, a setback of 500 ft (152 m) was applied to preserve ecosystems associated with fish havens and artificial reefs, and to avoid recreational user activity for WEA planning. There are only 3 fish havens within the recommended Galveston Preliminary WEA.

Fishing activities were broadly considered during the Area ID stage of the process to ensure that major conflicts are identified and addressed to the extent practicable, but further outreach and consideration of fishing issues will continue throughout the several phases of the BOEM process. BOEM understands that the placement and development of floating wind turbines could impact certain types of commercial fishing (e.g., pelagic longline and shrimping). BOEM will continue to study the exact types of fishing and areas that are of most concern and work with industry, state, and the fishing community to mitigate these concerns.



[21] United Nations Environment Programme (UNEP). 2009. London Convention and Protocol/UNEP guidelines for the placement of artificial reefs. London (UK): United Nations Environment Programme.
[22] NOAA. 2016. Understanding fish havens. Available from: https://nauticalcharts.noaa.gov/publications/docs/us-chart-1/UnderstandingFishHavens- 2016Feb.pdf

Figure 26: Map depicting notworthy characterization features for the Galveston Preliminary WEA (Option I).

2. DoD Activities

As noted above in Section V.D.3, DoD identified potential conflicts with Department of Navy training denoted in the red areas identified in Figure 27 and with radar used by North American Aerospace Defense Command (NORAD). The recommended Galveston Preliminary WEA requires further study relating to Relocatable Over the Horizon Radar (ROTHR). ROTHR supports DoD/U.S. Southern Command counter-narcotics missions. The identified lease blocks are located within and adjacent to the look angle of ROTHR transmit and receive sites. Other assessments have shown that wind turbines located within the look angle can degrade ROTHR performance (based on modeling conducted for the Kitty Hawk Wind Energy Area off the coast of North Carolina). It is acknowledged that the conditions in Texas are different than North Carolina, such as the distance between the sites and potential offshore development. The additional study area in the DoD assessment occurs throughout the GOM Call Area.

BOEM has eliminated areas that conflict with most DoD activities and will resolve remaining conflicts within the recommended Preliminary WEAs (denoted in light orange in Figure 27) during the process of identifying lease areas for a PSN, where certain areas may be excluded from leasing, and by developing site-specific stipulations in coordination with DoD.

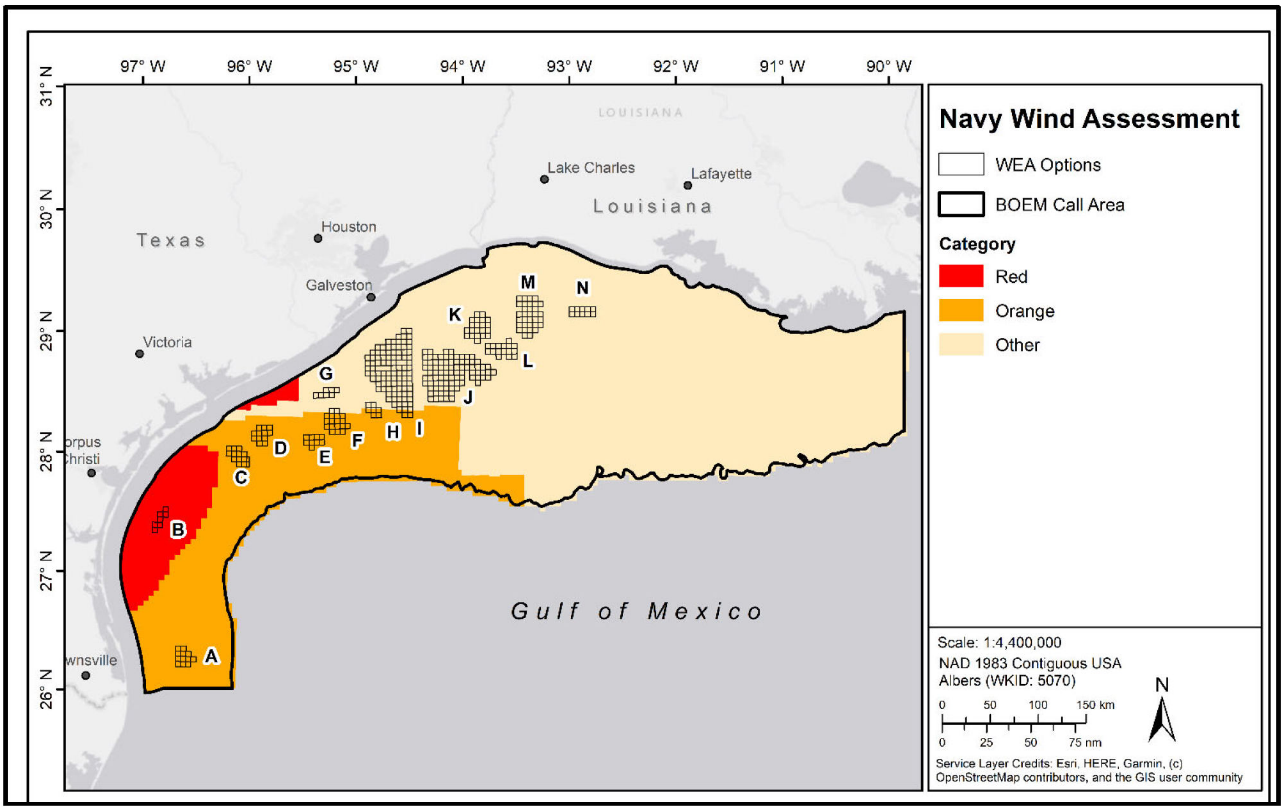


Figure 27: Initial DoD assessment for Wind Exclusion Areas (red areas) for the GOM Call Area. The orange areas require further analysis and study and the light orange areas may require additional mitigations.

3. Navigation

BOEM recognizes that the proximity of the recommended the Galveston Preliminary WEAs to the fairways near the blocks may present a concern to mariners in this region, particularly to vessels that may be experiencing mechanical or technical difficulties and require more room to maneuver. Based on the 2019 AIS track line analysis for Tanker Vessel traffic, however, a majority of tanker vessel traffic is largely confined to shipping fairways transiting on either side of the area. Some tankers could alter course to avoid any structures. BOEM therefore considered a 2 nm buffer between the fairway and the recommended WEA. Site-specific navigation studies may be conducted if the site is proposed for development, which will inform the siting of any future wind energy facility.

4. Commercial Viability

The recommended Galveston Preliminary WEA had the greatest interest from developers in response to the Call with 5 nominations. This area was recommended as a WEA because it provides enough acreage for several commercially viable projects, while avoiding potential conflicts with DoD activities and reducing potential conflicts with most of the fishing activities within the Call Area. The recommended WEA is close to shore, close to the Port of Galveston, close to points of interconnection onshore, and in shallow waters, which may decrease development costs relative to deeper sites farther from shore.

The National Renewable Energy Laboratory (NREL) Revenue model used wind speed, closeness to shore, proximity to population centers and the cost of electricity prices to determine economic viability of a commercial wind facility. Regions where locally high electricity prices coincide with lower cost of energy have the highest net value, which is a primary indicator for economic viability. Based on the NREL data from 2015, the recommended WEA is also in the high net value area. BOEM used this dataset in the economics submodel.

C. Lake Charles Preliminary WEA (Option M)

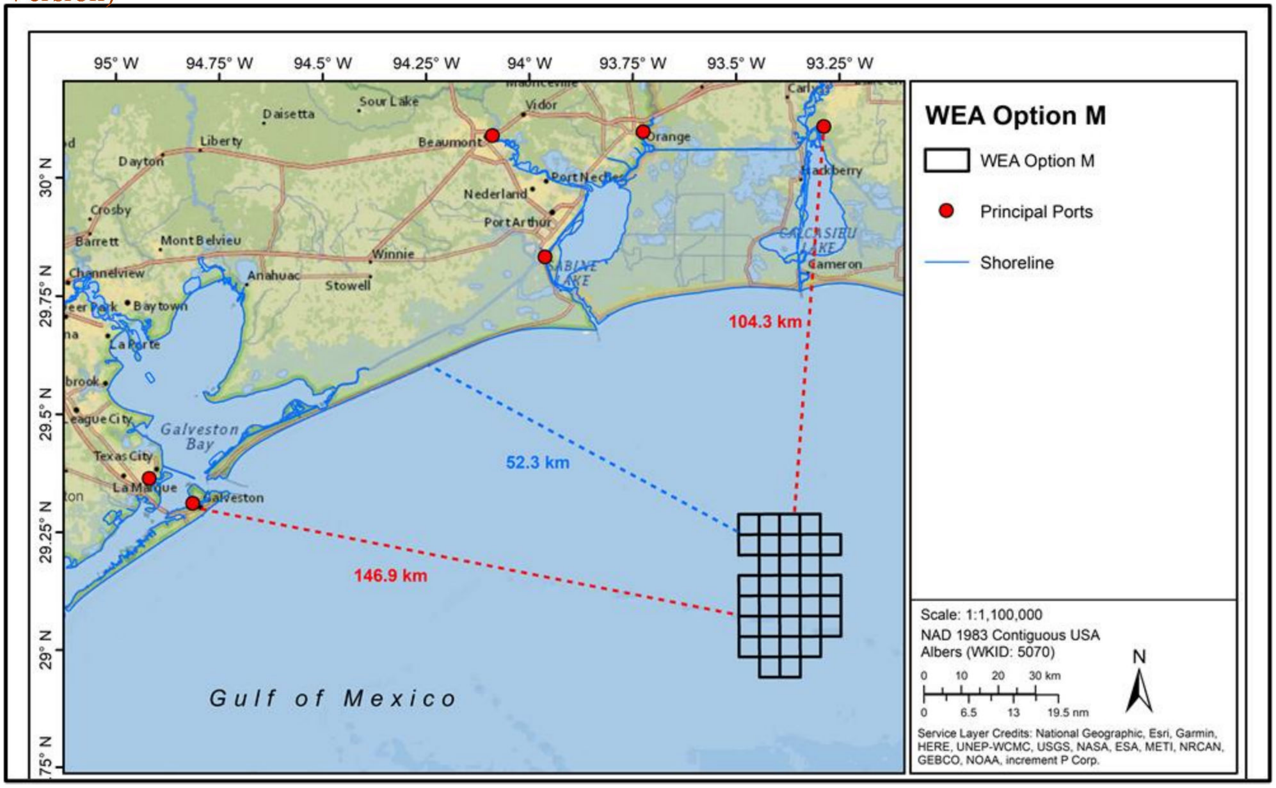


Figure 28: Lake Charles Preliminary WEA

BOEM acknowledges that offshore wind activities in portions of the recommended Lake Charles Preliminary WEA could potentially result in conflicts with other uses of these areas. The recommended Lake Charles Preliminary WEA was chosen by balancing several factors, the most prominent being DoD activities, commercial fishing, navigation, and commercial viability. BOEM understands that the placement and development of floating wind turbines could impact certain types of commercial fishing (e.g., pelagic longline and shrimp fisheries). Due to the recommended Lake Charles Preliminary WEA being in water depths less than 60 meters, currently, floating wind turbines will not be used in this area. BOEM will continue to study the exact types of fishing and areas that are of most concern and work with industry, state, and the fishing community to mitigate these concerns.

1. *DoD Activities*

As noted above in Section V.D.3, DoD identified potential conflicts with Department of Navy training denoted in the red areas identified in Figure 27 and with radar used by NORAD. BOEM has eliminated areas that conflict with most DoD activities and will resolve any remaining conflicts within the recommended Preliminary WEAs (denoted in light orange in Figure 27) during the process of identifying lease areas for a PSN, when certain areas may be excluded from leasing, and by developing site-specific stipulations in coordination with DoD.

2. *Vessel Navigation*

BOEM recognizes that the proximity of the recommended Lake Charles Preliminary WEA to the fairways near the blocks may present a concern to mariners in this region, particularly to vessels that may be experiencing mechanical or technical difficulties and requiring more room to maneuver. Therefore, BOEM considered a 2 nm buffer between the fairway and the recommended Preliminary WEA. Based on the 2019 AIS trackline data, most vessels travel within the bounds of the established traffic lanes. Site-specific navigation studies may be conducted if the site is proposed for development, which will inform the siting of any future wind energy facility.

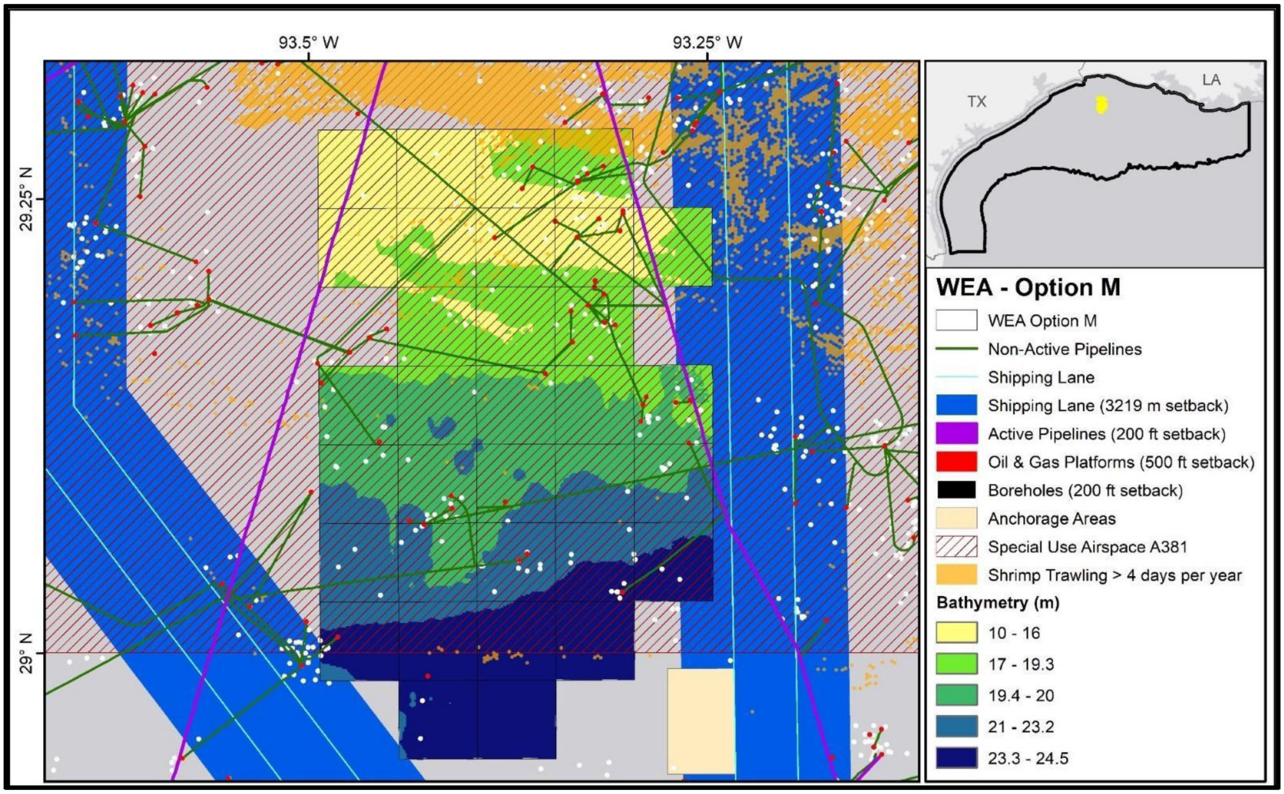


Figure 29: Map depicting shipping lanes and other noteworthy characterization features for the Lake Charles Preliminary WEA (Option M).

3. *Fisheries*

The shrimp fishery has the largest overlap within the Call Area, especially in areas closer to shore. However, the recommended Lake Charles Preliminary Wind Energy Area was determined to be relatively less impactful to fisheries interests with less than five percent for shrimp fishing areas of moderate-high fishing. The menhaden fishery had a six percent overlap within the Call Area and was predominately present off the coast of Louisiana. The recommended Lake Charles Preliminary WEA is located outside of the recommended 20 nm coastline buffer for menhaden fisheries. The 20 nm coastline buffer was recommended by the GOM menhaden fisheries. The Highly Migratory Species Pelagic Longline Gear and bandit gear fishing data showed a low overlap in the Call Area. The data also showed that pelagic longline and bandit gear fishing are in waters deeper than the recommended Lake Charles Preliminary WEA.

4. *Commercial Viability*

The Lake Charles Preliminary WEA was recommended because the size of the area provides enough acreage for more than one commercially viable project while avoiding potential conflict with DoD activities and reducing potential conflict with most of the moderate-high shrimp fishing activities within the Call Area. The Preliminary WEA is relatively close to shore and in shallow waters, which may decrease development costs relative to deeper water sites. The Preliminary WEA is also suitable for development not only due to opportunities for offtake from neighboring states, but also due to its proximity to points of interconnection, and consistent winds. In addition, the area overlaps with at least one nomination received in response to the Call.

VII. Changes from Call Area to Recommended Preliminary WEAs

After analyzing over 200 data layers and 54 datasets in the ocean planning study, the Call Area was substantially winnowed down based on the above factors and factors that were included in the constraints model including primarily the 20 nm coastline buffer, 100-400m buffer for the Rice's Whale, existing oil and gas infrastructure, active oil and gas leases, active pipelines, moderate-high shrimp fishing concerns, navigation, and national security interests. The original Call Area consisted of an area of approximately 30 million areas offshore Louisiana and Texas. After the ocean planning study, the Call Area was winnowed down to 2,398,150 acres with 13 potential WEA options. With the selection of the recommended Preliminary WEA options of Galveston (Option I) and Lake Charles (Option M), the Call Area would be further winnowed to 734,668 acres. The recommended Galveston Preliminary WEA (Option I) consists of 546,645 acres with the closest principal port being the Port of Galveston. The second area is the recommended Lake Charles Preliminary WEA (Option M) which consists of 188,023 acres with the closest principal port being Lake Charles. Both areas are located near onshore points of interconnection.

VIII. Director Concurrence for Preliminary WEA Recommendations

____✓____Yes

________No

7/20/22

Amanda Lefton
Director, Bureau of Ocean Energy Management

Date

2022 OMS-MISO Survey Results

Furthering our joint commitment to regional resource adequacy, OMS and MISO are pleased to announce the results of the 2022 OMS-MISO Survey

June 10, 2022

Projections and data do not account for impacts of recent and future tariff filings, including those related to Resource Availability & Need

Given the capacity outlook for 2023 and beyond, efforts must be accelerated and reinforced to reliably manage the portfolio transition

- MISO is projected to have a capacity deficit of 2.6 GW below the 2023 PRMR. Depending on market responses to the 2022 PRA, projected capacity surplus could be as much as 2.4 GW
- Similar to the 2022 PRA results, the capacity deficit is restricted to MISO North/Central, partially offset by exports from the South region
- Capacity deficits are projected to widen in subsequent years, consistent with past surveys
- Demand growth is projected to continue post-Covid recovery in 2023 at +1 GW (+0.8% compared to 2022 PRA), but modest growth thereafter at 0.2% per year

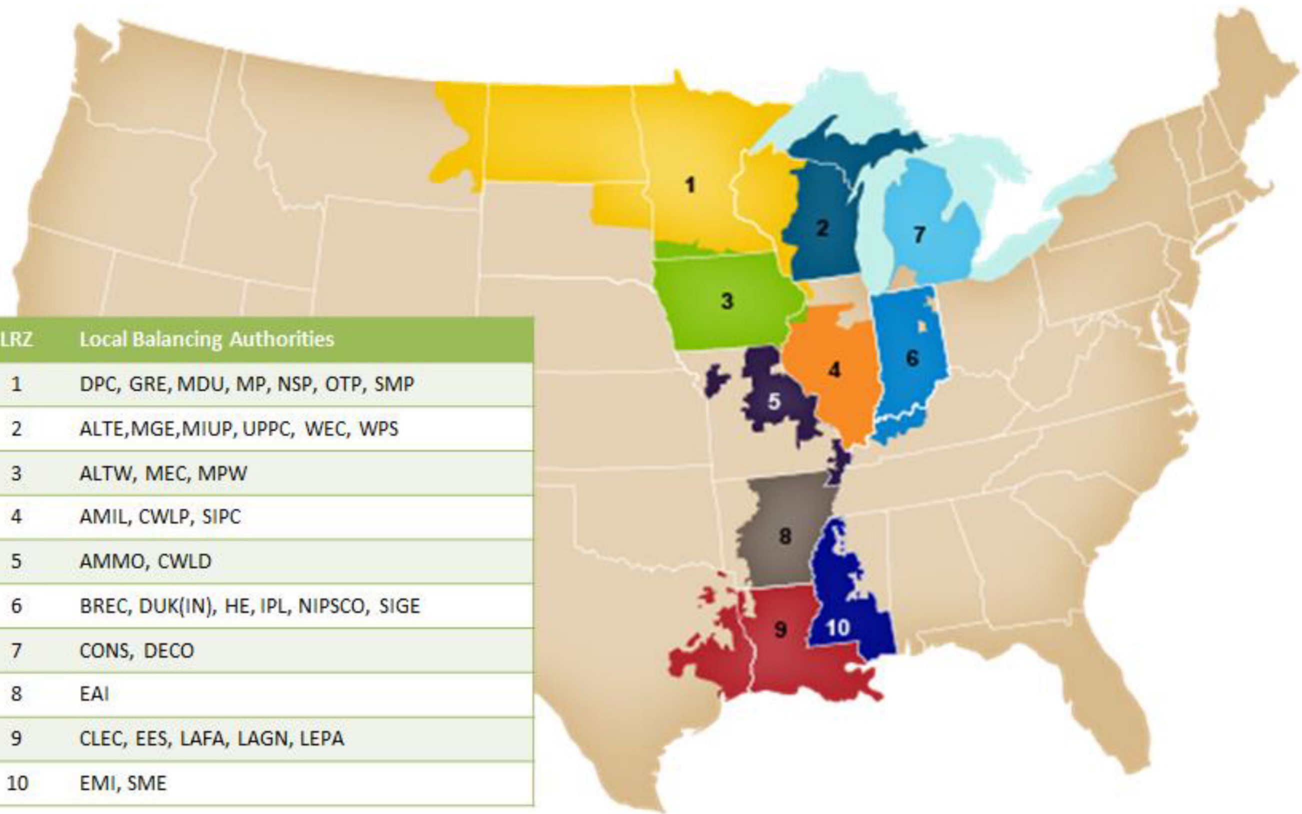
Implications: To ensure reliable operations, MISO will be increasingly reliant on emergency or non-firm resources, such as imports, which are not reflected in the survey but have historically been important and available to MISO

Note: 99% of Load participated in OMS-MISO Survey in 2022

Capacity mentioned is Unforced Capacity (UCAP) - PRMR: Planning Reserve Margin Requirement

MISO Resource Adequacy Requirements

- Load serving entities within each zone must have sufficient resources to meet load and required reserves
- Surplus resources may be shared among load serving entities with resource deficits to meet reserve requirements



LRZ	Local Balancing Authorities
1	DPC, GRE, MDU, MP, NSP, OTP, SMP
2	ALTE,MGE,MIUP, UPPC, WEC, WPS
3	ALTW, MEC, MPW
4	AMIL, CWLP, SIPC
5	AMMO, CWLD
6	BREC, DUK(IN), HE, IPL, NIPSCO, SIGE
7	CONS, DECO
8	EAI
9	CLEC, EES, LAFA, LAGN, LEPA
10	EMI, SME

The survey uses three categories to help characterize relative levels of resource certainty

Committed Capacity

- Consists of installed generation resources and projects with interconnection agreements with commercial operation dates expected during survey year
- This report assumes that these resources will be used to meet the PRMR

Potentially Unavailable Resources

- Consists of installed generation resources whose commitment to MISO is unclear
- This report assumes that these resources will NOT be used to meet the PRMR

Potential New Capacity

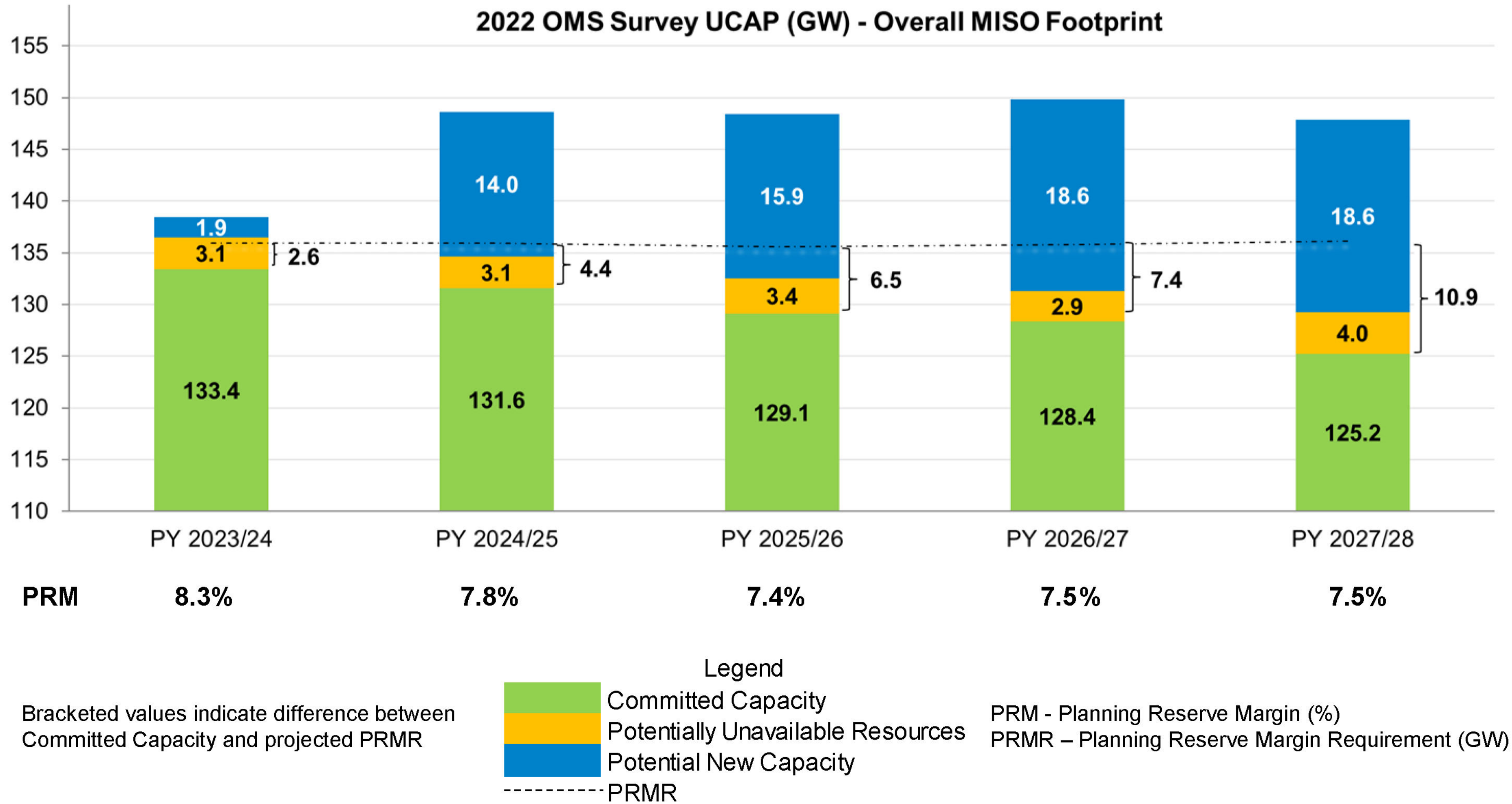
- Consists of projects in MISO's generation interconnection queue with capacity weighted consistent with past years*

Potential New Capacity (Alternative Method)

- Alternative method - Historically MISO has seen 2-3 GW of new capacity energized annually (assumes average of 2.5 GW/year)

* Descriptions of Resource Categories and Queue Treatment on slides 14 - 16 in appendix
Capacity mentioned is Unforced Capacity (UCAP).

Committed capacity projections show deficit increasing over survey period. Depending on the pace of resource retirements and new capacity additions, risk can be meaningfully mitigated



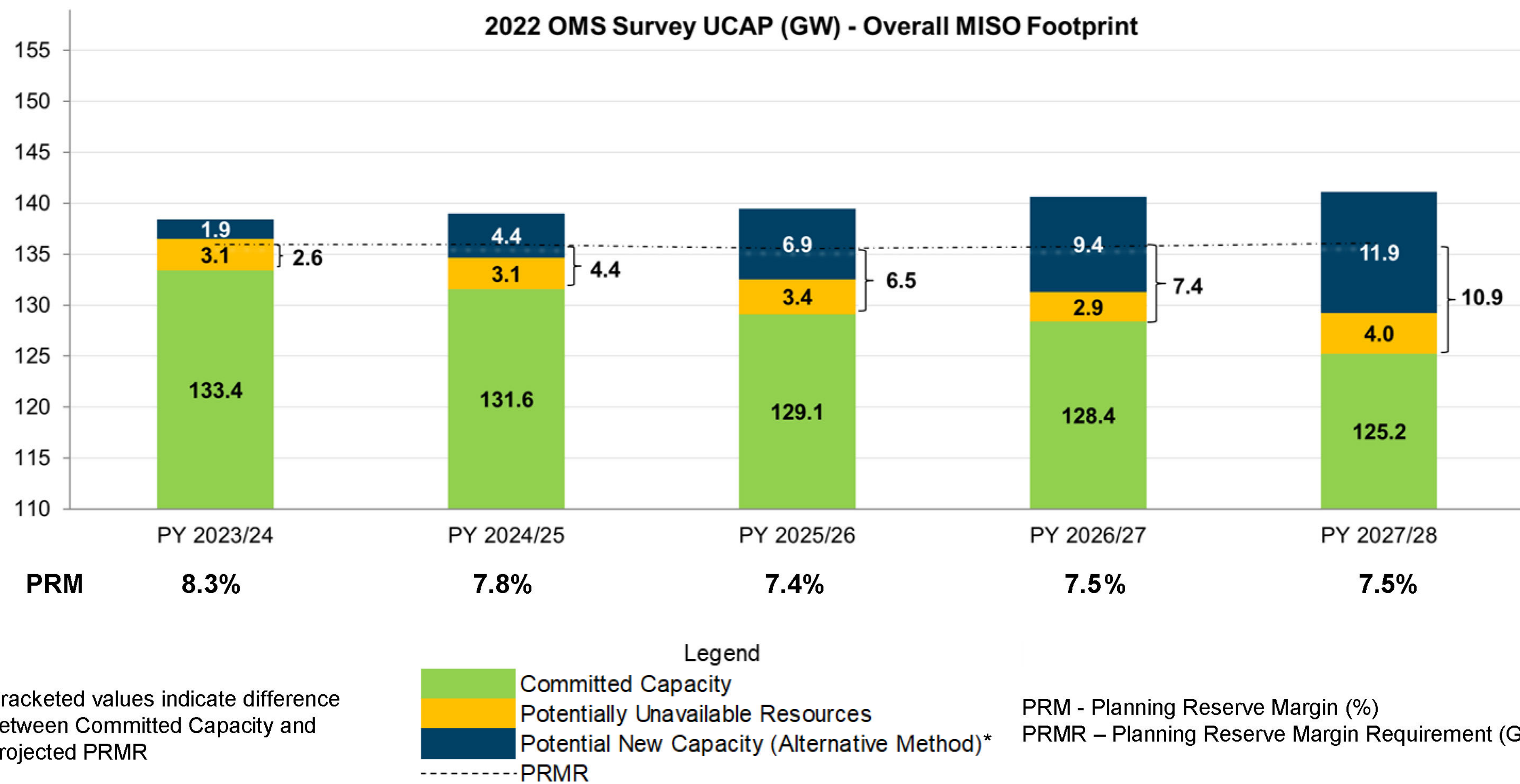
Bracketed values indicate difference between Committed Capacity and projected PRMR

PRM - Planning Reserve Margin (%)
PRMR – Planning Reserve Margin Requirement (GW)

RDT limit of 1900 MW is reflected in this chart

Note: Potential New Capacity projected per methodology consistent with past years.

Alternative method based on historical installations of 2.5 GW/year would indicate reduced 'potential new capacity'



Bracketed values indicate difference between Committed Capacity and projected PRMR

PRM - Planning Reserve Margin (%)
PRMR – Planning Reserve Margin Requirement (GW)

*Alternative method reflects historical rate of actual capacity additions in MISO
Note: RDT limit of 1900 MW is reflected in this chart

External factors can impact projected deficits or surpluses

Downside Risks

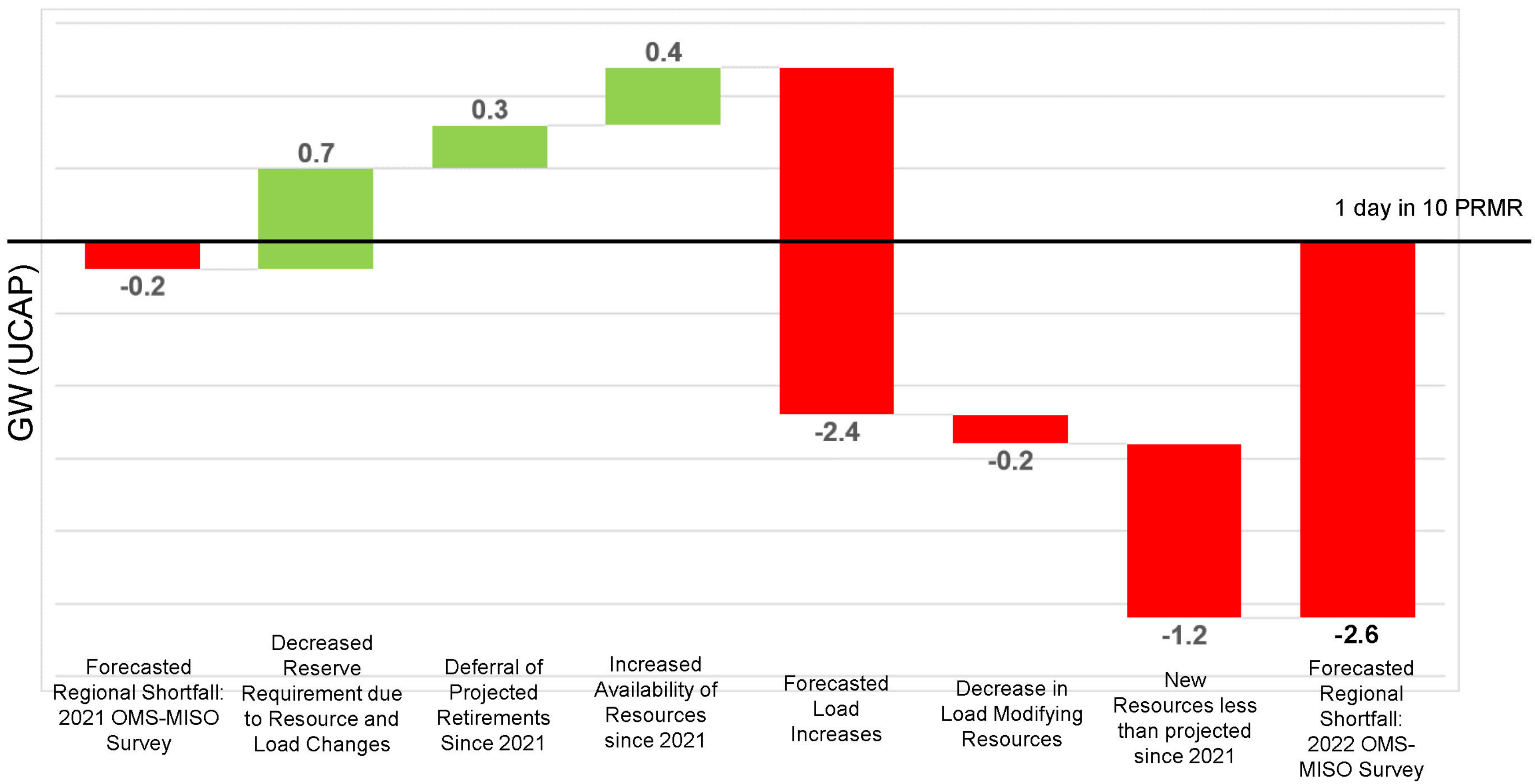
- Accelerated retirements
- Reduction in projected capacity additions
- Bulk of new resources are at lower capacity accreditations
- Delays due to solar tariff investigations & supply chain bottlenecks
- Higher load growth due to electrification

Upside Possibilities

- Lower than expected load growth
- Potential additional capacity in response to 2022 PRA outcomes
  - Return to service of suspended resources and deferred retirements
  - Additional External Resources
  - Additional LMR registrations
- Leveraging recent queue improvements

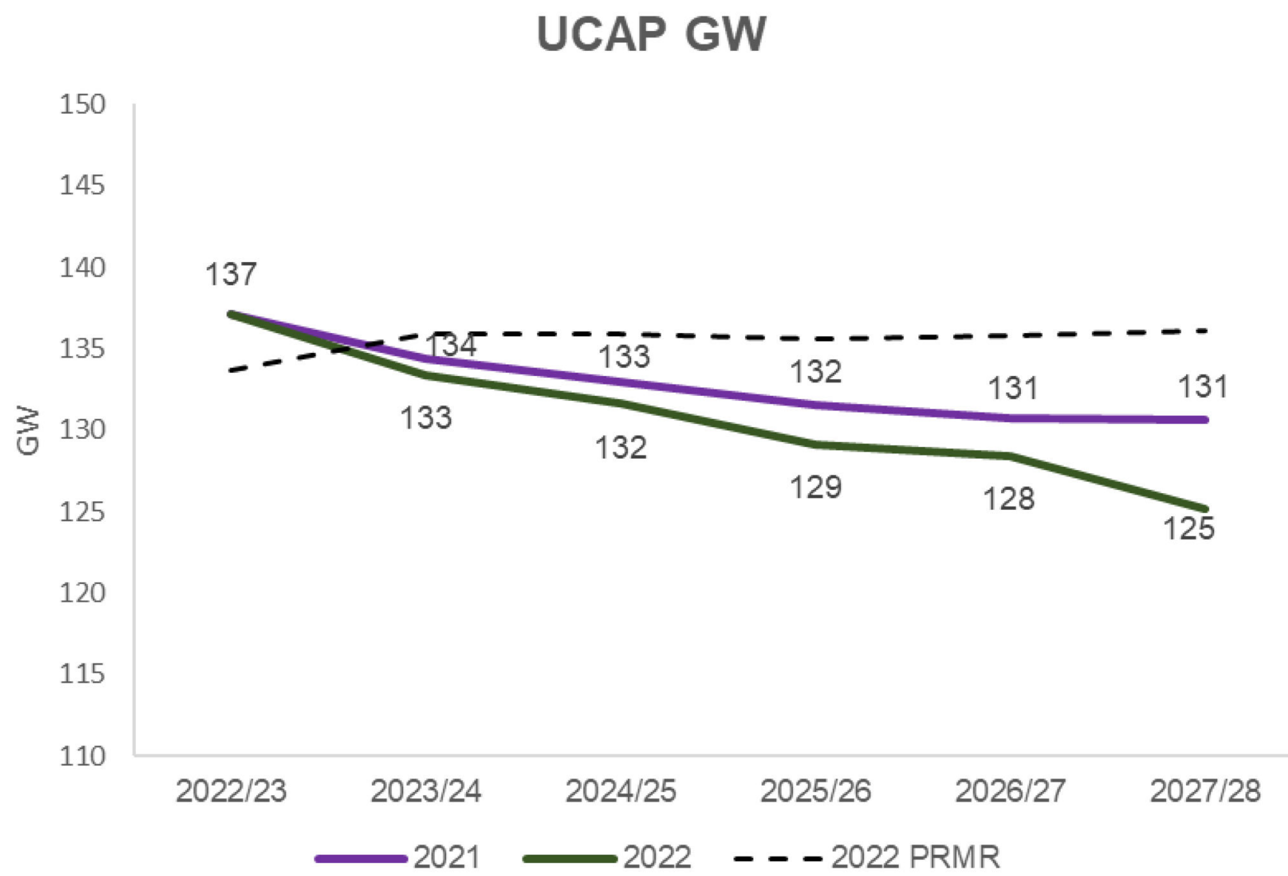
Comparison of year-over-year survey results for 2023 indicates a reduction of committed capacity with higher load growth

2023 Regional Outlook
Reconciliation between 2021 & 2022 OMS MISO Survey for 2023

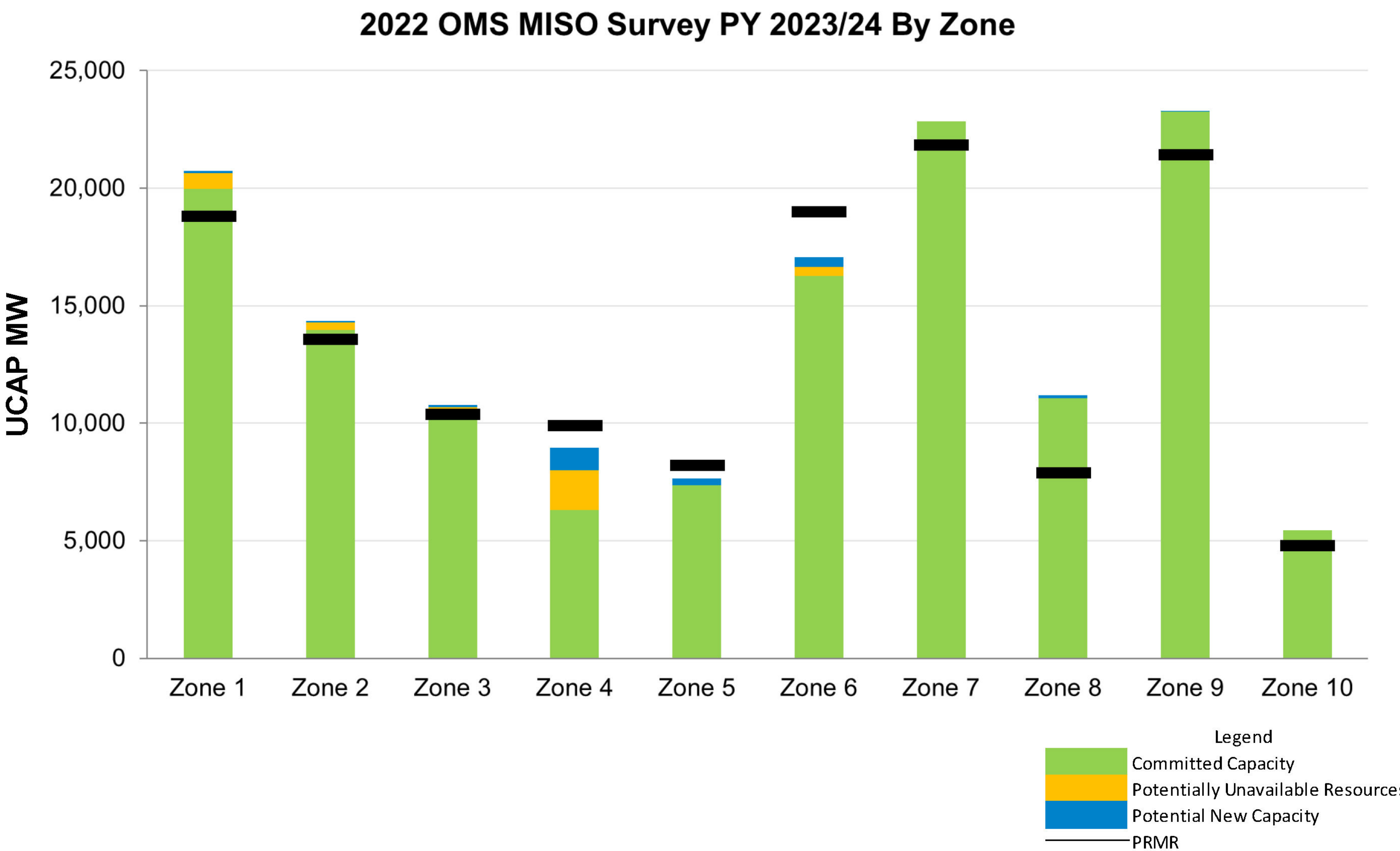


New resources include resources with newly signed Interconnection Agreements; wind at ELCC, solar at 50%
Increased availability results from potential resources from 2021 survey that are now committed resources
LMRs – Load Modifying Resources are Demand Response (DR) and Behind the Meter Generation (BTMG)

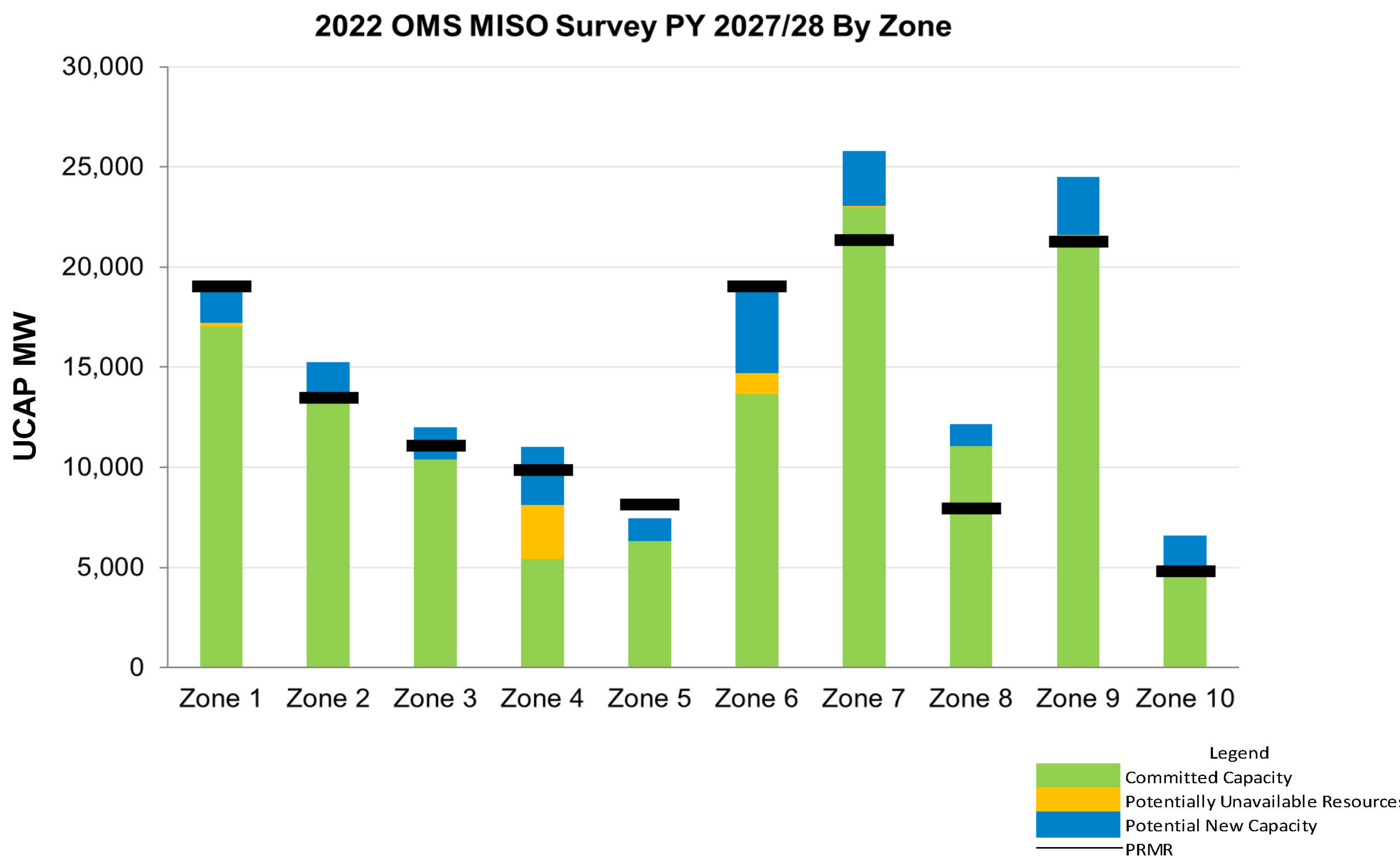
Across the five-year outlook, projected Committed Capacity has decreased in 2022 as compared to the 2021 survey



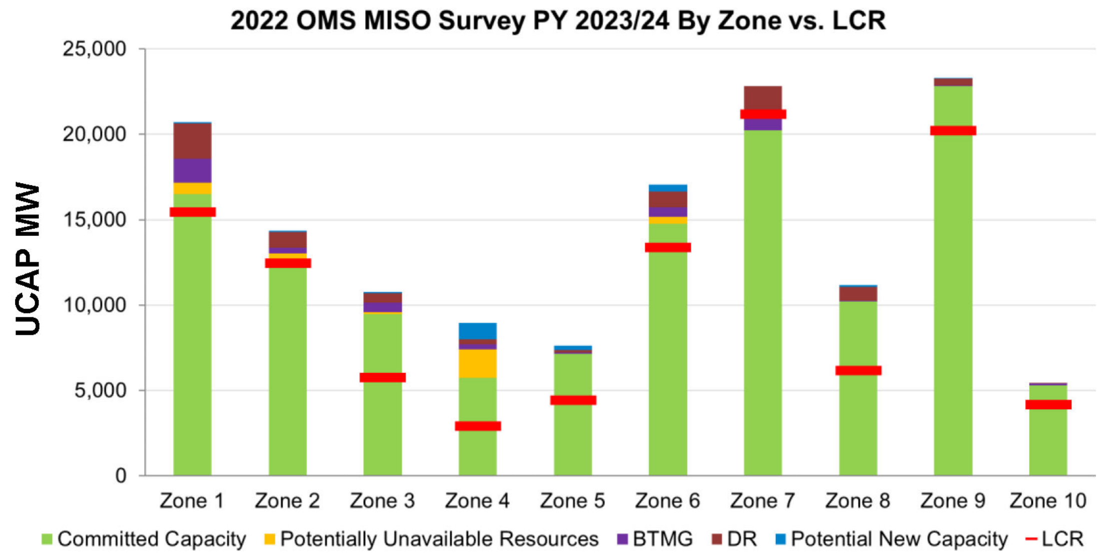
Capacity shortages shown in 2022 PRA are reflected in the 2023 survey zonal outlook

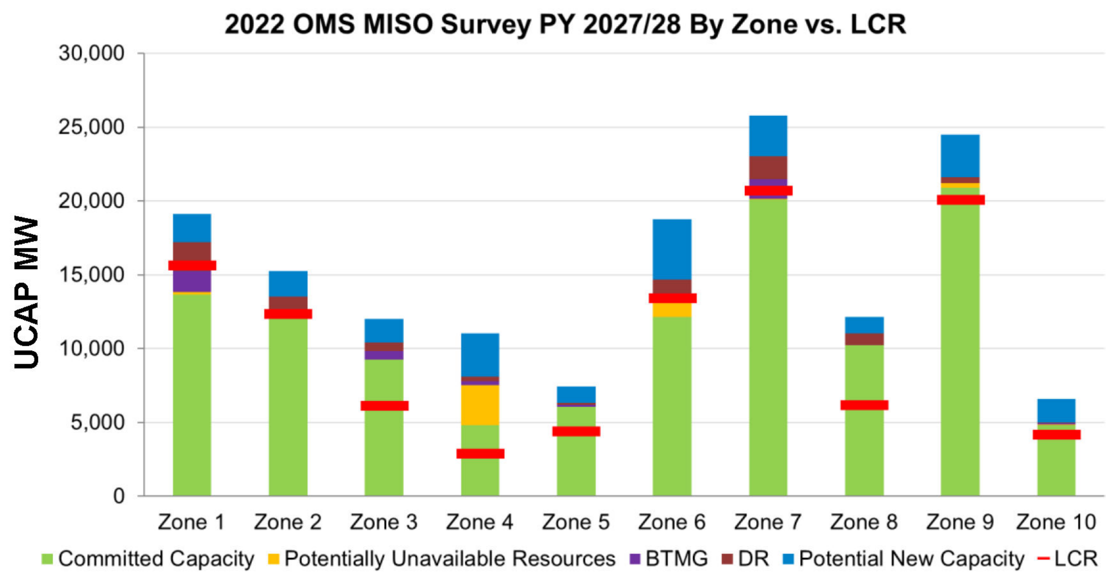


By 2027, North/Central will need completion of significant number of MISO GI projects to cover projected Committed Capacity deficit



New generation and load modifying resources continue to be important in meeting local resource needs





- Includes only projected capacity resources within the zone, i.e. does not include imports and interzonal transfers
- Potential Capacity includes both new generation and potential retirements
- Load Modifying Resources include Demand Response (DR) and Behind the Meter Generation (BTMG)

Appendix

Understanding Resource Categories

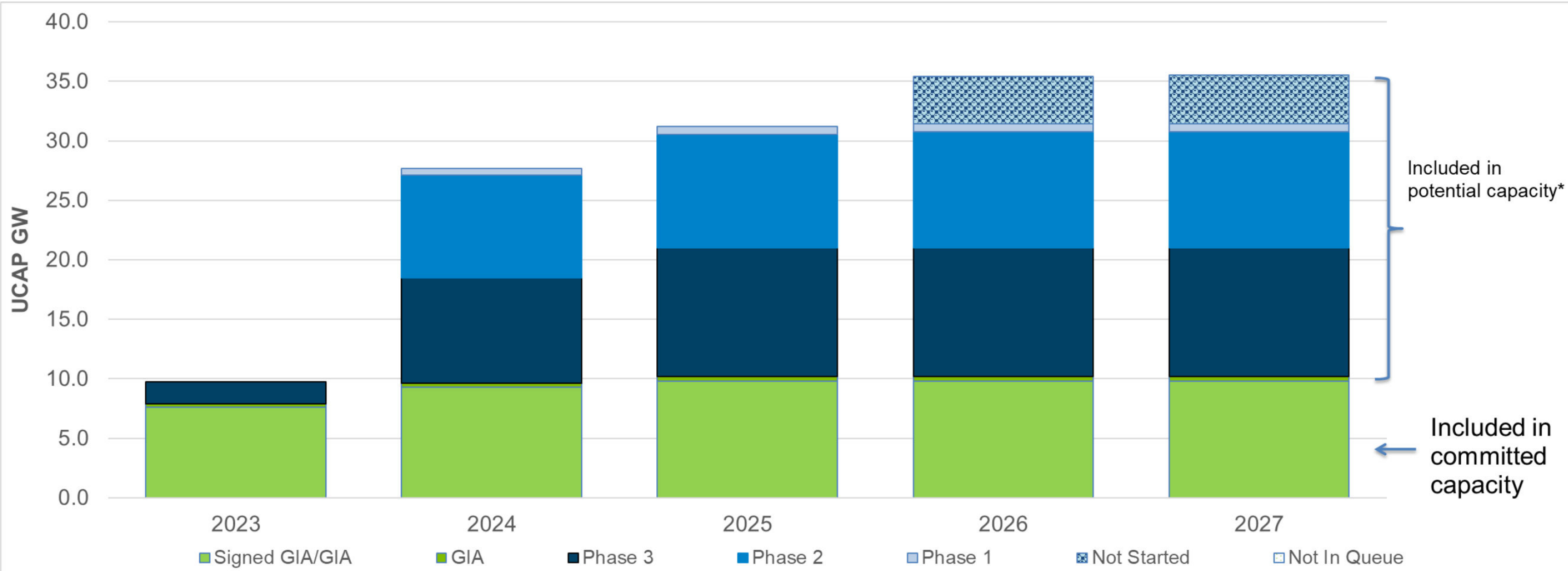
- **Committed Capacity** - resources committed to serving MISO load
  - Resources within MISO utilities' rate base
  - New generators with signed interconnection agreements
  - External resources with firm contracts to MISO load
  - Non-rate base units without announced retirements or commitments to non-MISO load

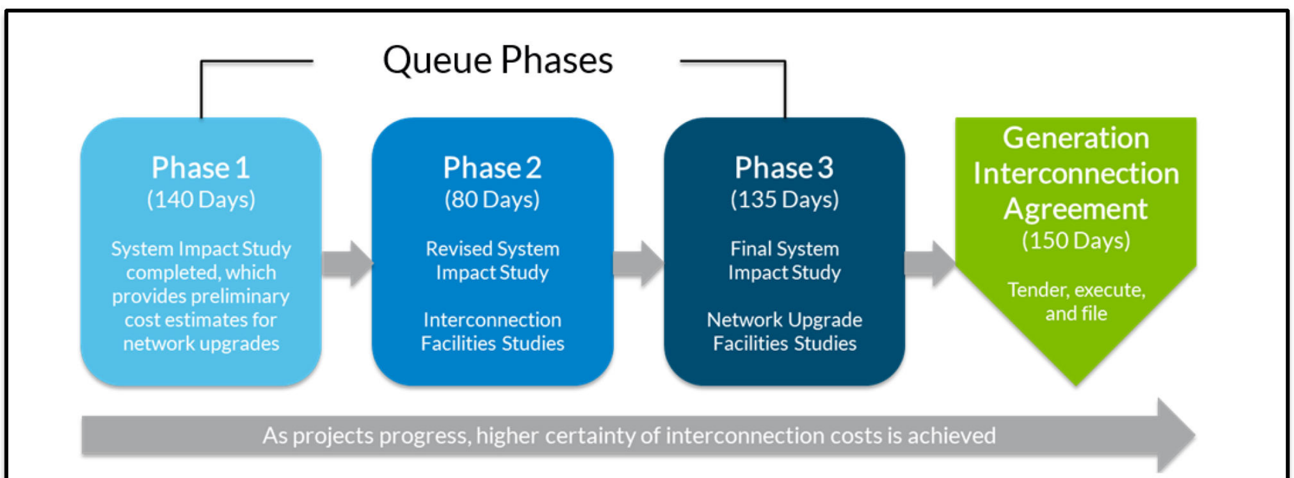
- **Potentially Unavailable Resources** - resources that may be available to serve MISO load but may not have firm commitments to do so
  - Indicated as Low Certainty in survey results by Market Participants
  - Includes potential retirements or suspensions

- **Potential New Capacity** - UCAP for new resource projects in the MISO Generator Interconnection Queue accredited at the current (2022) new resource capacity credit levels and adjusted for projected queue certainty factors

- **Unavailable resources** are not included in the survey totals
  - Resources with firm commitments to non-MISO load
  - Resources with finalized retirements or suspensions
  - Potential new generation which **are not currently** in the MISO Generator Interconnection Queue

Future resource ranges will shift as planned generation interconnections are firmed up





"Potential capacity" values shown here are higher than amounts shown on slide 4 because they do not factor in RDT limitations.

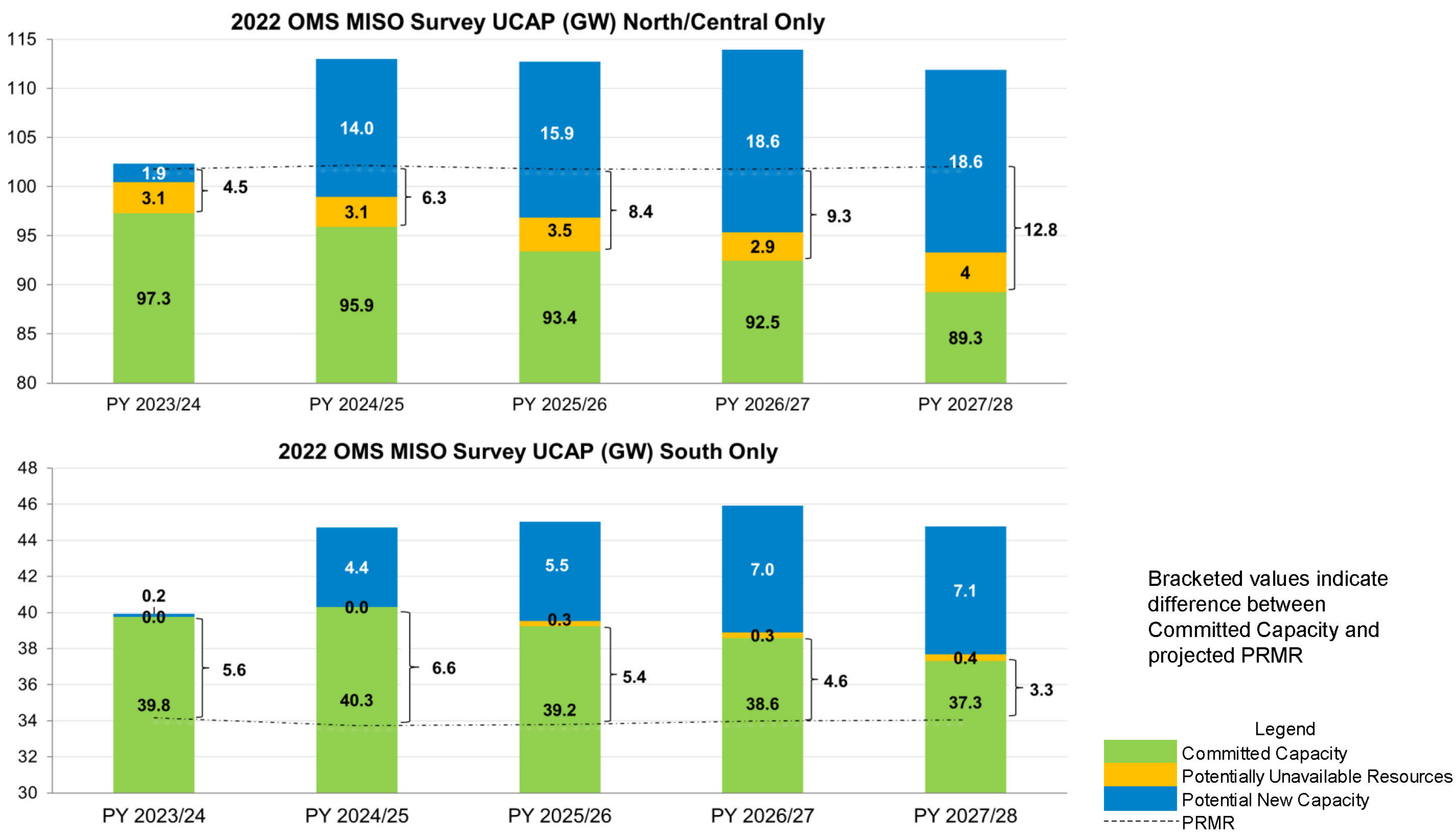
- Potential New Capacity represents capacity in the MISO Generator Interconnection Queue at projected queue certainty factors as of April 28, 2022. Wind and solar resource UCAP values are accounted for at current new resource capacity credit values (15.5% ELCC for Wind, 50% for solar).

2022 OMS-MISO Survey Queue Treatment

Apply Capacity Credit	Apply DPP Study Phase Weighting	Requested In-Service Date	DPP Study Cycle Not Started
Wind 15.5%	Not Started and Phase 1= 10%	**If requested in-service date is prior to the first Survey year, projects moved to their DPP study cycle end date, unless an updated date provided in the OMS-MISO Survey**	**If DPP Study Cycle not started, the requested in-service dates are moved to the DPP study cycle end date plus 2 years unless updated date provided in the OMS-MISO Survey**
Solar 50%	Phase 2 = 75% Non-Intermittent, 50% Intermittent		
All other 100%	GIA in Progress and Phase 3 = 90%		

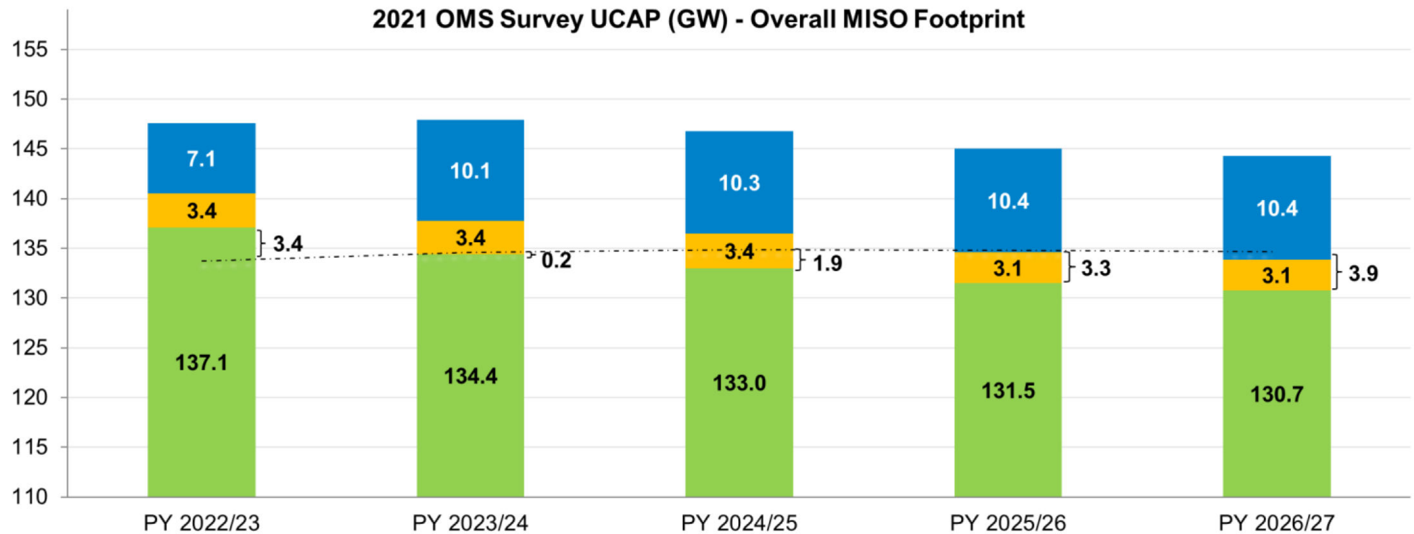
- DPP Study Phase Weighting is applied to recognize that as projects move through the queue process, the likelihood of completion generally becomes more certain.
- In-service date adjusted if the DPP Study Cycle phase is "Not Started" to recognize that a project likely can't get capacity credit until at least the end of the DPP study cycle **and an additional 2 years** to to reflect expected GIA dates and construction timelines.

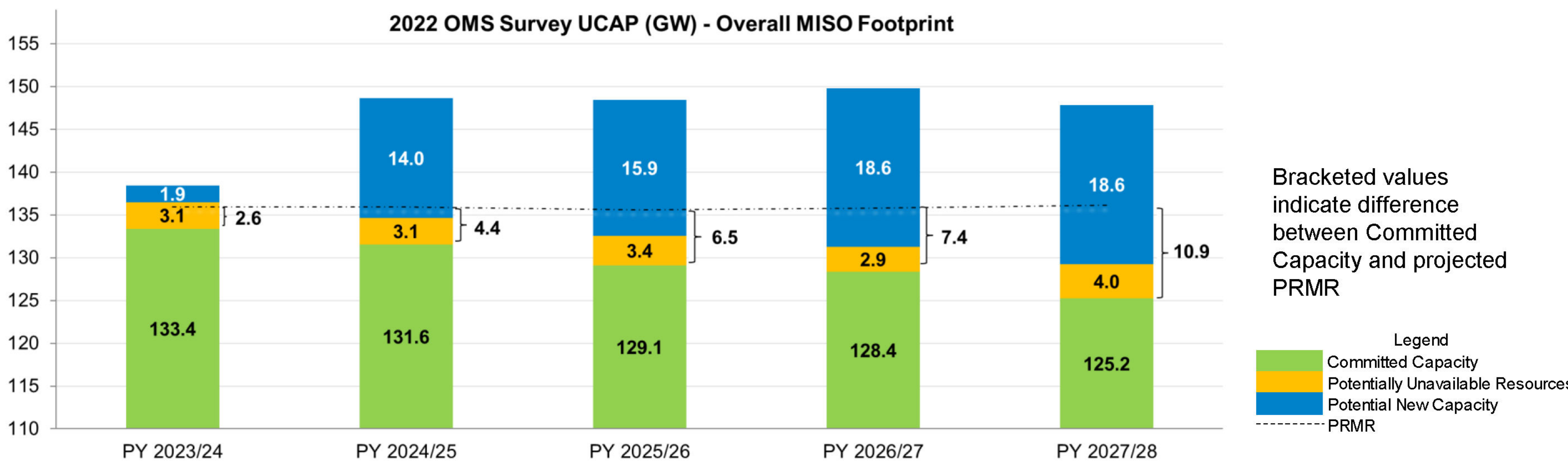
Similar to the 2022 PRA results, North/Central is projected to have a shortage while the South sub-region has a surplus



While RDT is not reflected in these charts the limit is currently 1900 MW in Resource Adequacy

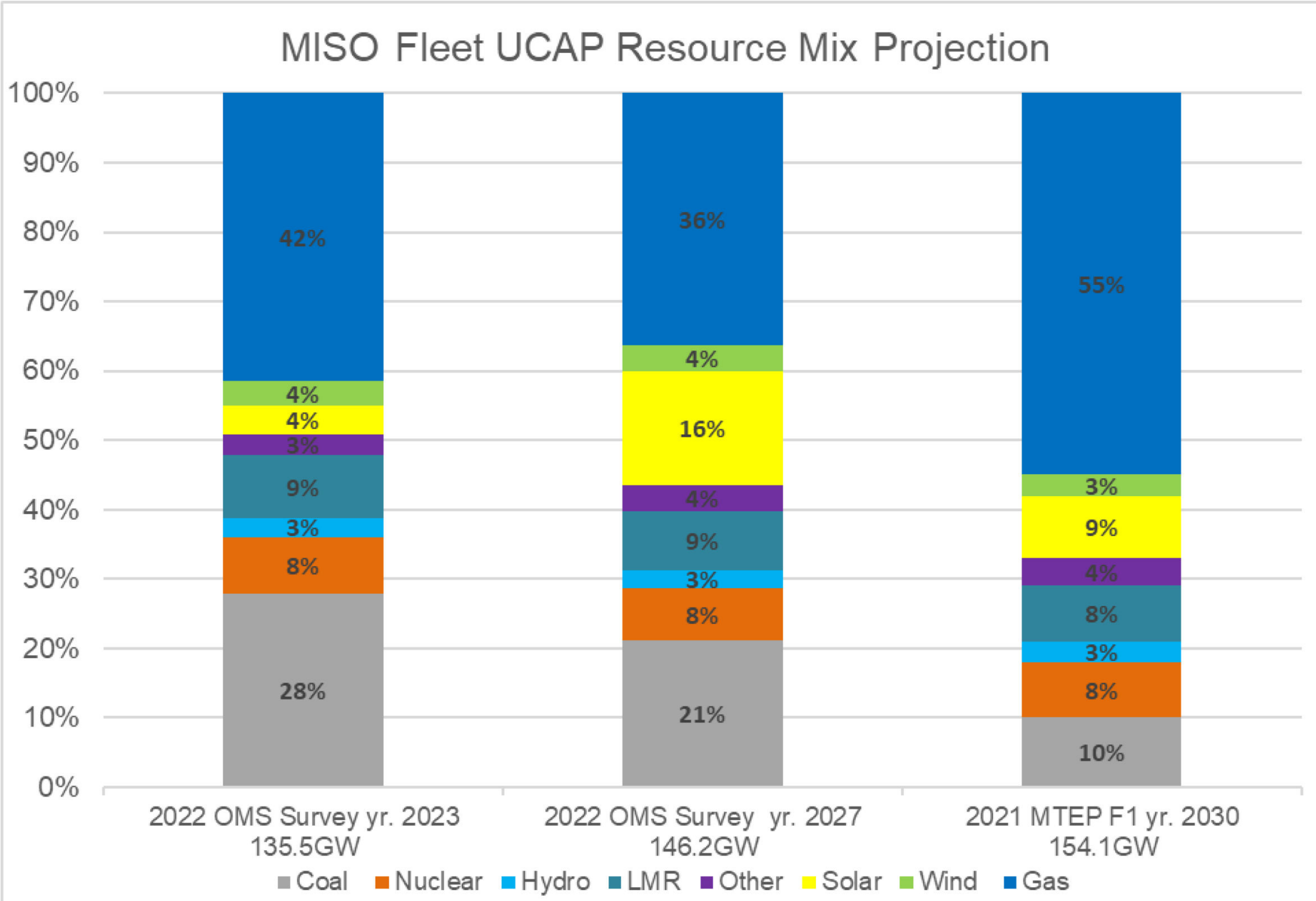
Projected Capacity GW → Committed Capacity has decreased as compared to 2021 survey across the five-year outlook





Bracketed values indicate difference between Committed Capacity and projected PRMR

Forecasted resource mix continues to show increasing reliance on gas and renewables



- Wind and solar resources shown at current new resource capacity credit accreditation (15.5% ELCC for Wind, 50% for solar)
- Hybrid resources combined in solar category in OMS survey ~2.5GW in 2027