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California ISO

Transmission Planning for Offshore Wind

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November 10, 2022

CEC – AB525: Offshore Wind Transmission Workshop

Transmission Planning Process

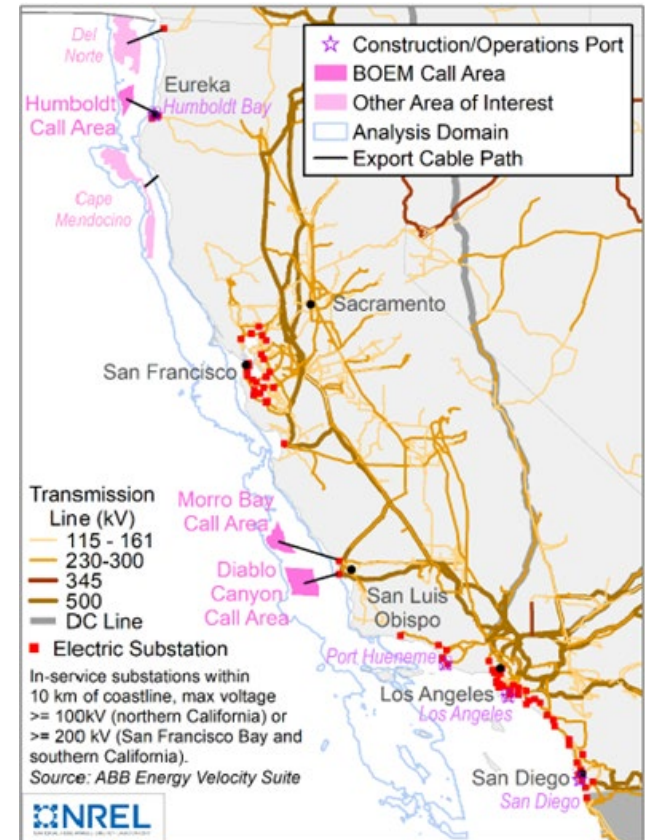
- The CAISO conducts an annual tariff based transmission planning process to assess needs for reliability, policy and economic driven transmission
 - Is currently conducted on a 10-year planning horizon
- The CAISO issued its first 20-Year Transmission Outlook in May 2022 that is intended to:
 - help the state to further refine resource planning,
 - scope the challenges we face,
 - and provide longer term context for decisions made in the 10-year transmission plan process.

CAISO Offshore Wind Studies

- In the 2021-2022 transmission planning process the CPUC provided a sensitivity portfolio to assess the transmission development required to integrate offshore wind
 - 8.3 GW of offshore wind for detailed analysis
 - An addition 12.2 GW of offshore wind in North coast area for high level assessment
- In addition within the 20-Year Transmission Outlook the SB100 Starting Point scenario included 10 GW of offshore wind resources
 - Analysis based on 2021-2022 transmission planning process studies

Description of 2021-2022 transmission planning process Sensitivity 2 Portfolio

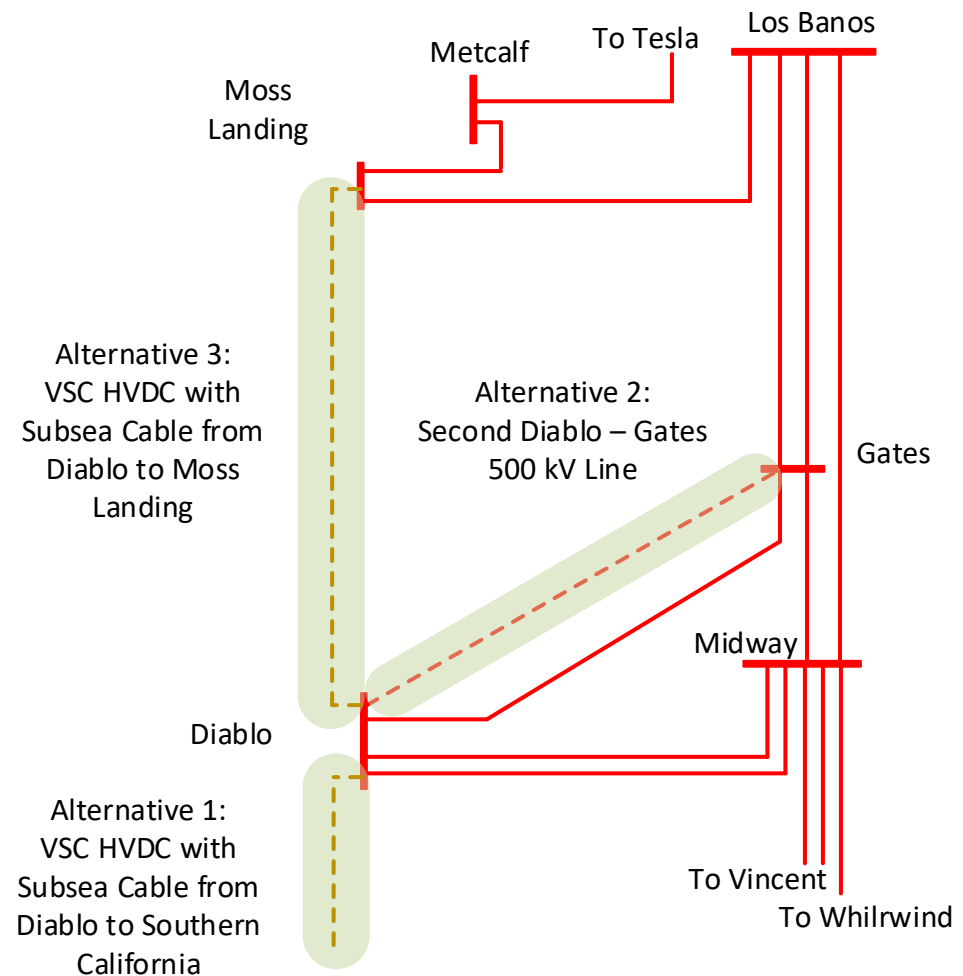
- Sensitivity 2 includes the following offshore wind resources:
 - Humboldt: 1.6 GW
 - Diablo Canyon: 4.4 GW
 - Morro Bay: 2.3 GW
- In addition, an outlook assessment was performed to accommodate the remaining offshore wind resource potential:
 - Del Norte: 6.6 GW
 - Cape Mendocino: 6.2 GW
- The total offshore wind in the outlook is 21.1 GW



Source: [The Cost of Floating Offshore Wind Energy in California Between 2019 and 2032 \(nrel.gov\)](#)
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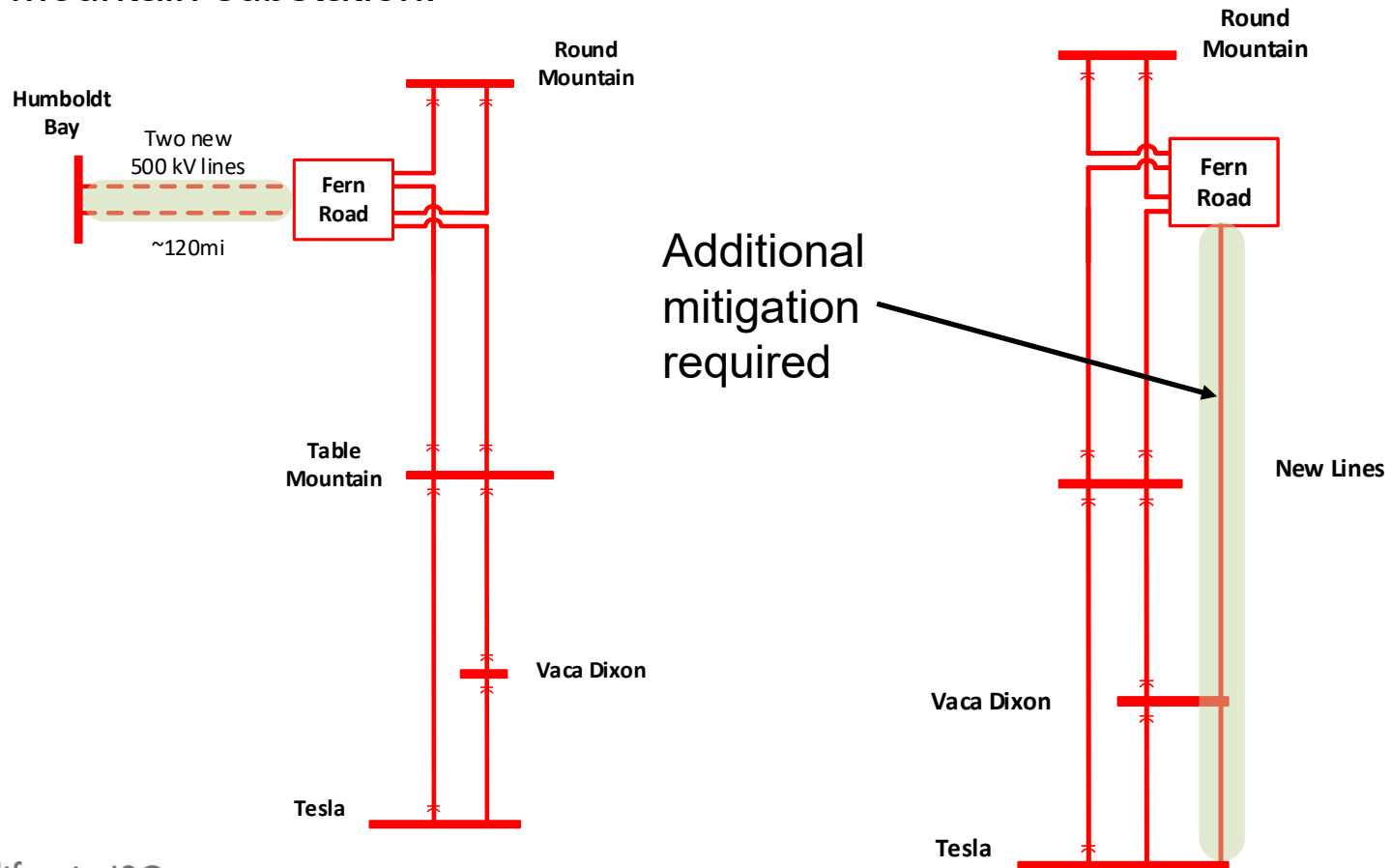
Central Coast – Offshore Wind

- The analysis identified that 5.3 GW of resources can connect to the 500 kV system in the Diablo/Morro Bay area after the retirement of the Diablo Nuclear Power Plant
- To increase the offshore capacity to the 6.4 GW included in sensitivity portfolio three alternatives were considered.



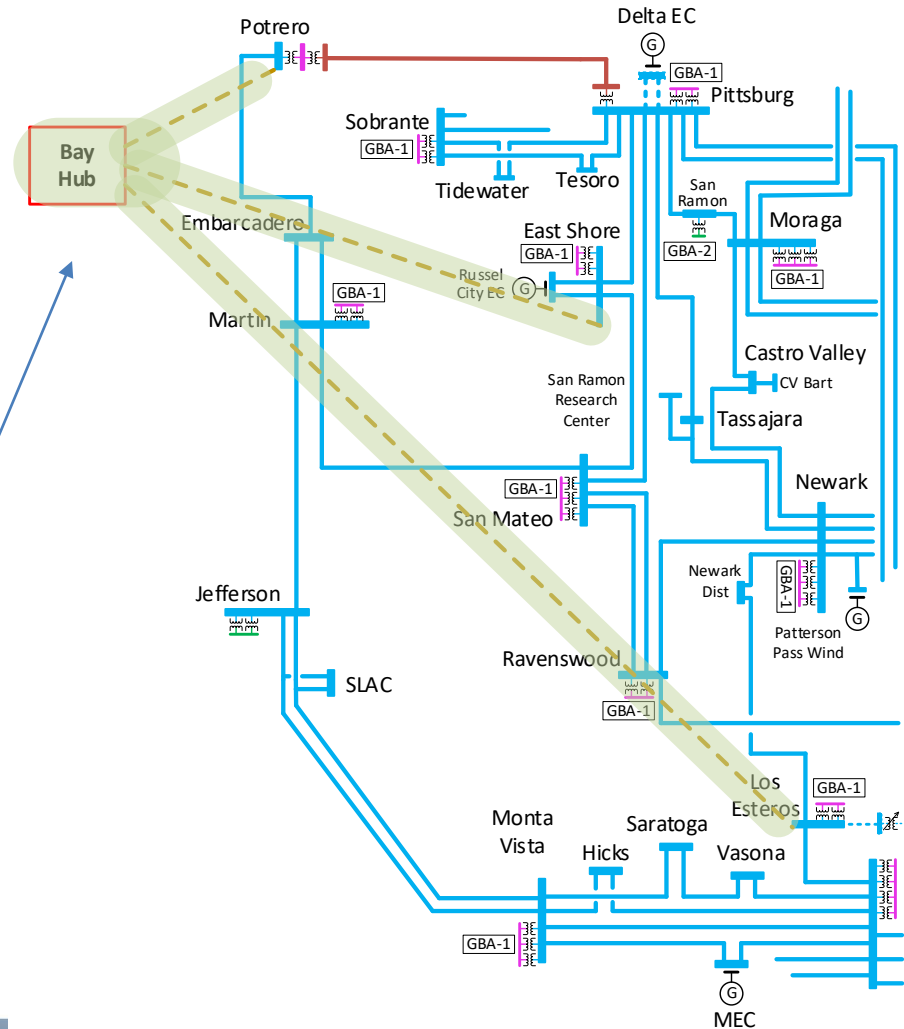
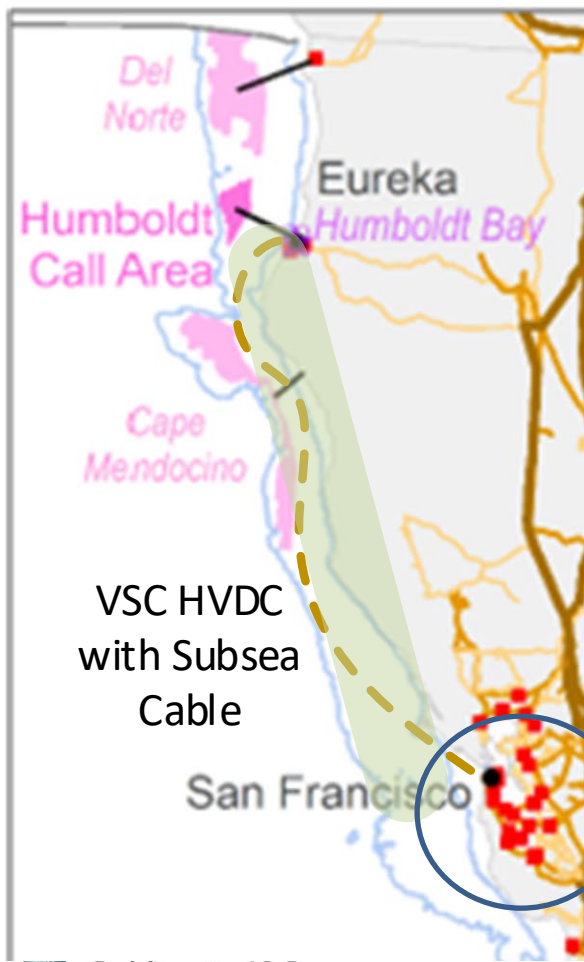
Humboldt 1.6 GW Interconnection Alternatives(1/3)

- Option 1: 500 kV AC line to Fern Road 500 kV substation.
 - Fern Road 500 kV substation is planned to be in service by June 2024 as part of Round Mountain DRS project and is located 11 miles south of Round Mountain substation.



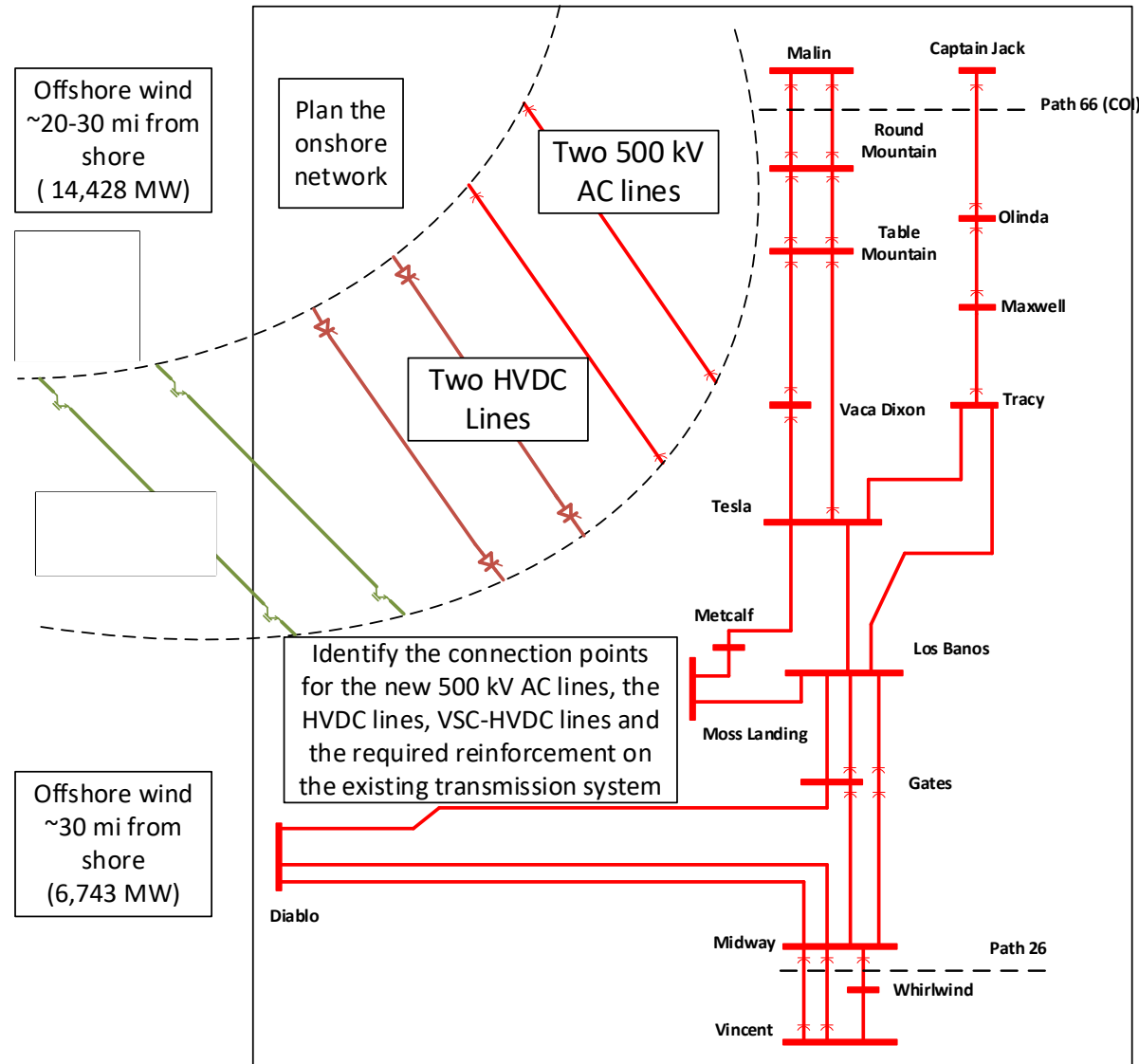
Humboldt 1.6 GW Interconnection Alternatives (2/3)

- Option 2: VSC-HVDC subsea cable to a converter station in the Bay area with 3 AC connections to Potrero, East Shore, and Los Esteros



Outlook Assessment with 14.4 GW OSW in North Coast

- Considering the study results with 1.6 GW at Humboldt, further evaluations was performed for interconnection of 14.4 GW of wind under outlook assessment.
- A review of possible technology options and configurations will be performed to integrate 14.4 GW of offshore wind in the north coast.



20-Year Transmission Outlook

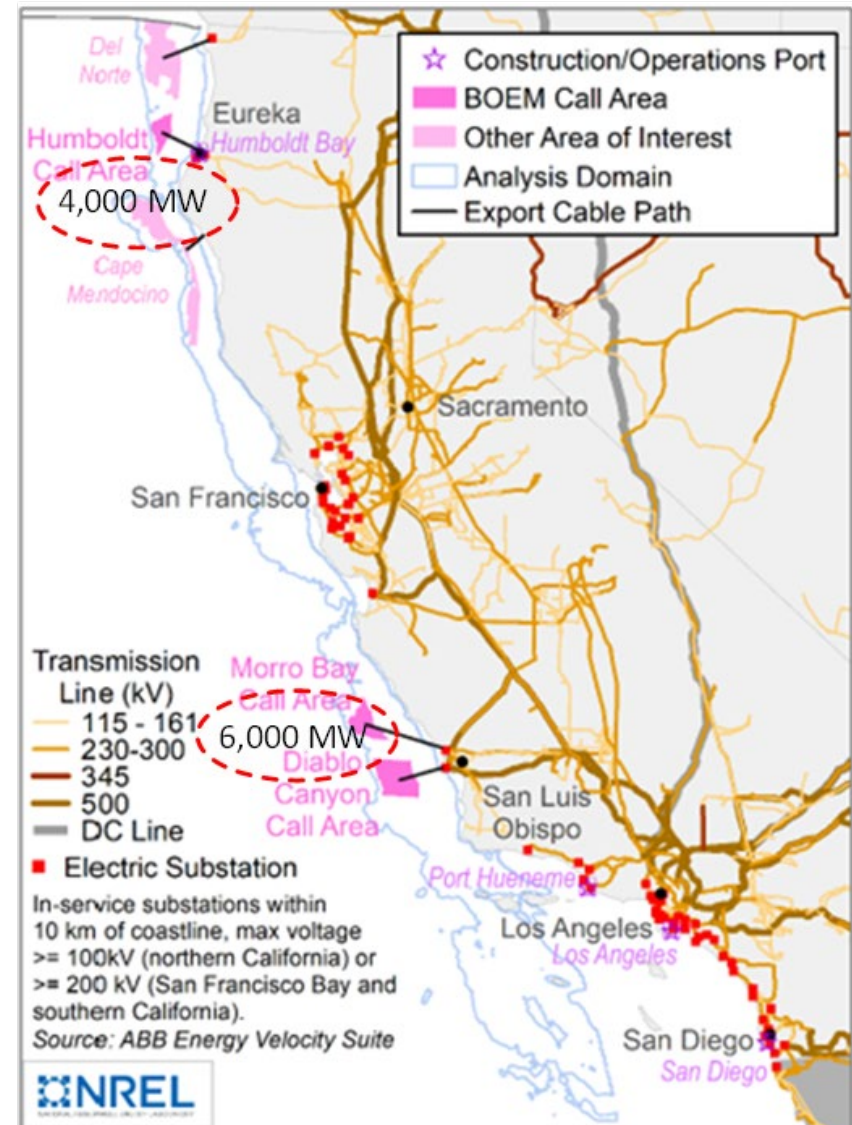
- The ISO has produced its first ever 20-Year Transmission Outlook focused on providing a longer term view of transmission needed to reliably meet state clean energy goals
- Issued in May 2022 and posted on the ISO website
<http://www.caiso.com/InitiativeDocuments/20-YearTransmissionOutlook-May2022.pdf>

20 YEAR TRANSMISSION OUTLOOK



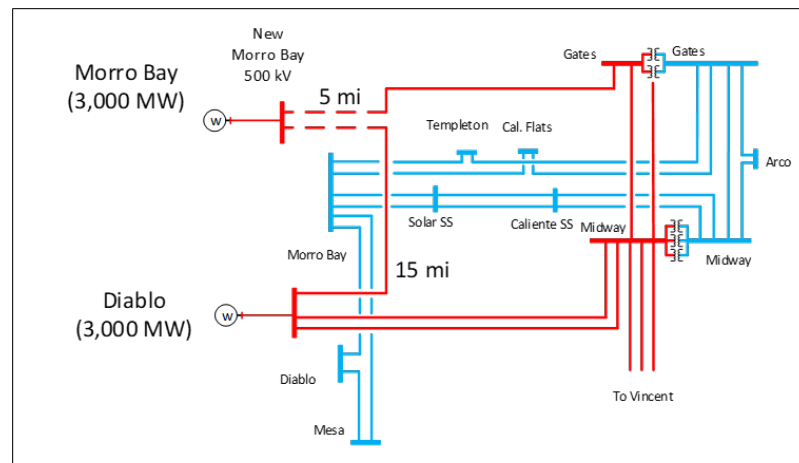
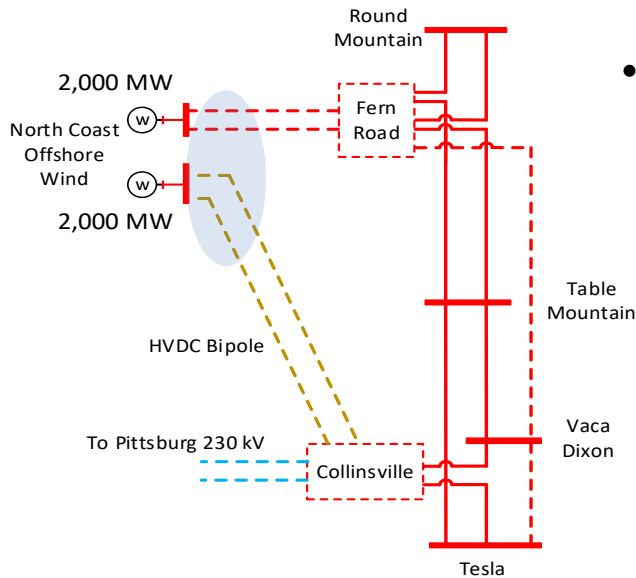
20-Year Transmission Outlook - Offshore Wind

- 10 GW of offshore wind
 - 6 GW in central coast
 - 4 GW in north coast
- Current areas of environmental and leasing development at Bureau Ocean Energy Management (BOEM)
 - Humboldt call area
 - Morro Bay call area



Offshore transmission development

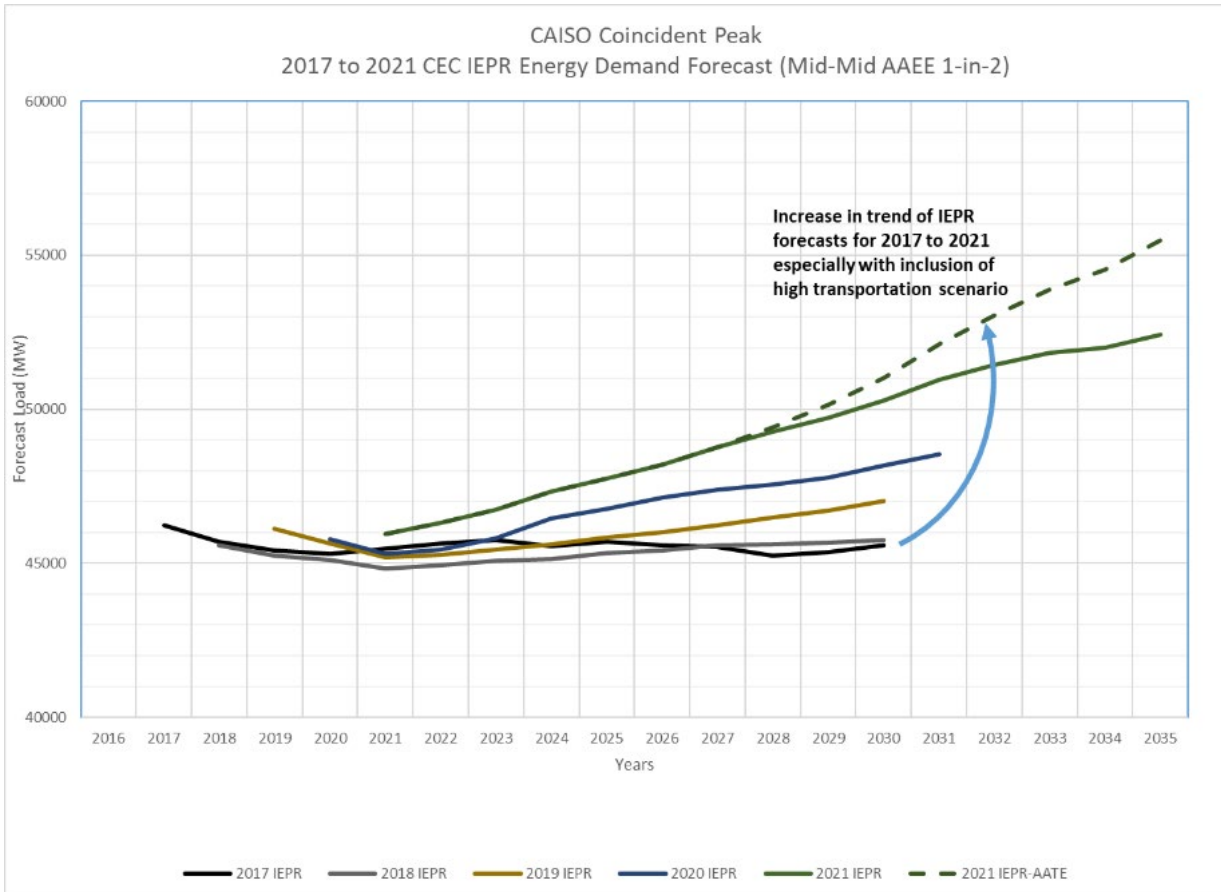
- Central coast offshore wind interconnecting to existing 500 kV in Diablo/Morro Bay area
- North coast offshore wind requires transmission development to interconnect to existing system
 - 500 kV AC interconnection to Fern Road
 - HVDC line to Collinsville
 - interconnect 500 kV AC and HVDC systems together and the offshore wind farms in two wind development areas
 - Potential for offshore grid development and strengthening of interconnection to Pacific Northwest



Transmission Development	Description	Cost Estimate
Humboldt Bay Offshore wind area	Total of 4,000 MW offshore wind connected through two of the following options: - Option 1 (Fern Road): \$2.3 B - Option 2 (Bay Hub): \$4.0 B - Option 3 (Collinsville): \$3.0 B Facilities required to interconnect the transmission options connecting to the different offshore wind areas: \$0.5B-\$1.0 B.	\$5.8 B-\$8.0 B
Diablo – Morro Bay Offshore wind area	- Total of 6,000 MW offshore wind. Connected to Diablo 500 kV and the new Morro Bay 500 kV substation. - The cost estimate is only for a 500 kV switching station and looping in the existing	0.11 B

2022-2023 Transmission Planning Process

Background - There is also continued acceleration in the pace for new resource and transmission development



CEC report setting targets for offshore wind
2 to 5 GW by 2030, 25 GW by 2045

Resource Additions:

2020-2021 Plan

- 10.4 GW in 10 years

2021-2022 Plan

- 27.7 GW in 10 years

2022-2023 Plan

- 40.1 GW in 10 years
- 86.5 GW in 2035 (sensitivity)

DRAFT 2023-2024 Plan

- 70.3 GW in 10 years
- 86.1 GW in 2035

20 year outlook 2040

- 120 GW in 20 years

Transmission Planning Process - Portfolios

	Portfolios for 2020-2021 Plan (2030)	Portfolios for 2021-2022 Plan (2031)	Portfolios for 2021-2022 Plan (2032)	30 MMT High Electrification Sensitivity Portfolio (2035)	20-Year Outlook SB100 Starting Point Scenario (2040)
Solar	6,763	13,044	17,506	40,879	53,212
Wind	992	4,005	3,531 in state 1,500 OOS 1,708 offshore	3,797 in state 4,828 OOS 4,707 offshore	2,237 in state 12,000 OOS 10,000 offshore
Battery storage	1,376	9,368	13,571	28,402	37,000
Gas-fired					
Biomass			134	134	
Geothermal	0	651	1,160	1,786	2,332
Pumped Hydro / Long Duration	1,256	627	1,000	2,000	4,000
Total	10,387	27,695	40,110	86,535	120,781
Gas retirements	0	0	~1,000	-1,000	-15,000

Table does not include behind-the-meter resources and supply-side demand response

2022-2023 Transmission Plan Milestones

- Draft Study Plan posted on February 18
- Stakeholder meeting on Draft Study Plan on February 28
- Final Study Plan posted on March 31
- Stakeholder meeting July 6
- Preliminary reliability study results posted and open Request Window on August 15
- Stakeholder meeting on September 27 and 28
 - Comments submitted by October 12
- Request window closed October 15
- Preliminary policy and economic study results on November 17
- Comments to be submitted by December 5
- Draft transmission plan to be posted on March 31, 2023 (was January 31)
- Stakeholder meeting in February
- Comments to be submitted within two weeks after stakeholder meeting
- Revised draft for approval at March Board of Governor meeting

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