

Overview of the 100 Percent Study

Greenhouse Gas Mitigation Working Group Meeting

June 21, 2022

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EXETER
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Study Scope

Scope based on requirements in the Clean Energy Jobs Act (CEJA) of 2019 and correspondence with State Senator Brian Feldman in February 2021

- Re-do selected portions of the Maryland RPS Study that PPRP submitted to the Maryland General Assembly in December 2019
- Assess the cost and benefits of a 100% RPS and a 100% clean energy standard by 2040
- Determine which industries and communities could be positively and negatively impacted
- Design mechanisms to alleviate any negative impacts for affected workers and communities
- Recommendations to change the Maryland RPS or recommendations for incorporation into future proposals for a Maryland clean energy standard

Project Organization

- Budget is limited to 20 scenarios
- Project will largely be done sequentially
 - Will do production cost modeling first, then input-output modeling for determining employment and community impacts
 - Mechanism design to mitigate negative community and employment impacts, and recommendations/conclusions closes the project.

Potential Scenarios

Initial Scenarios

- Base Case (50% RPS by 2030)
- 100% RPS by 2040
- 100% clean energy standard by 2040

Possible Sensitivity Scenarios

- High natural gas prices
- Electrification

- Climate Solutions Now Act
 - 60% reduction GHG emissions by 2031
 - Carbon neutral by 2045
- PJM High Renewables/Clean Energy
- Retirement or Relicensing of Calvert Cliffs (depending on results of previous model runs)
- Only in Maryland (all generation has to be located in Maryland)

We're using Vibrant Clean Energy's WIS:dom Model

- Both a capacity expansion model and a production cost model
- Continental-scale, spatially-determined co-optimization of transmission, generation and storage expansion while simultaneously determining the dispatch of these sub systems at 13-km or 3-km, hourly or 5-minute resolution
- Dispatch includes:
 - Individual unit commitments, start-up, shutdown profiles, and ramp constraints;
 - Transmission power flow, planning reserves, and operating reserves;
 - Weather forecasting and physics of weather engines;
 - Detailed hydro modeling;
 - High granularity for weather-dependent generation;
 - Existing generator and transmission asset attributes such as heat rates, line losses, power factor, variable costs, fixed costs, capital costs, fuel costs, etc.;

Project Schedule (Subject to Change)

- Currently: Run model/analyze results for first three scenarios
- Mid-July: Working group meeting to review results from first three scenarios and to recommend scenarios
- Mid-November: Working group meeting to review results from scenarios. Start input-output modeling
- Spring/summer 2023: Draft and finalize report
- January 1, 2024: Final deadline for providing the report to the Governor per CEJA

Working Group

- Membership -- Utilities, PJM, renewable energy developers/industry groups, other energy companies/industry groups, citizens, state agencies/orgs, county agencies/associations
- All working group meetings are open to the public
- Documentation – all presentations and comments will be posted on PPRP's website (<https://dnr.maryland.gov/pprp/Pages/default.aspx>). Assumptions are discussed in the presentations
- Communications – Primary POC – Fred Kelley, PPRP, frederick.kelley@maryland.gov

Conclusion

- First model runs are underway—working group meeting expected in mid-July
- Contact Fred or Kevin if you have questions or feedback, especially on the scenarios
- Working group meetings are open to the public

Appendix

Assumptions in VCE Model – Reference Case (Current RPS)

	MD Tier 1 RPS		Offshore			Total MD	
	Requirement*	Solar	Wind	Geothermal	Tier 2	RPS	
Year	(%)	(%)	(MW)	(%)	(%)	Requirement	
2021	30.80	7.50	0	0	2.50	33.30	
2022	30.10	5.50	0	0	2.50	32.60	
2023	31.90	6.00	0	0.05	2.50	34.40	
2024	33.70	6.50	270	0.15	2.50	36.20	
2025	35.50	7.00	270	0.25	2.50	38.00	
2026	38.00	8.00	2,044	0.50	2.50	40.50	
2027	41.50	9.50	2,044	0.75	2.50	44.00	
2028	43.00	11.00	2,044	1.00	2.50	45.50	
2029	47.50	12.50	2,044	1.00	2.50	50.00	
2030	50.00	14.50	2,044	1.00	2.50	52.50	
* Inclusive of carve-outs		US Wind Phase 2, Skipjack Phase 1 & 2					

Assumptions in VCE Model – Reference Case (Current RPS, Coop)

	MD Tier 1 RPS		Offshore			Total MD
	Requirement*	Solar	Wind	Geothermal	Tier 2	RPS
Year	(%)	(%)	(MW)	(%)	(%)	Requirement
						(%)
2021	30.80	2.50	0	0	2.50	33.30
2022	30.10	2.50	0	0	2.50	32.60
2023	31.90	2.50	0	0.05	2.50	34.40
2024	33.70	2.50	270	0.15	2.50	36.20
2025	35.50	2.50	270	0.25	2.50	38.00
2026	38.00	2.50	2,044	0.50	2.50	40.50
2027	41.50	2.50	2,044	0.75	2.50	44.00
2028	43.00	2.50	2,044	1.00	2.50	45.50
2029	47.50	2.50	2,044	1.00	2.50	50.00
2030	50.00	2.50	2,044	1.00	2.50	52.50
	* Inclusive of carve-outs					

Assumptions in VCE Model – Reference Case (Current RPS, Muni)

	MD Tier 1 RPS		Offshore			Total MD
	Requirement*	Solar	Wind	Geothermal	Tier 2	RPS
Year	(%)	(%)	(%)	(%)	(%)	Requirement
2021	18.45	1.95	0	0	2.50	20.95
2022	18.45	1.95	0	0	0.00	18.45
2023	18.45	1.95	0	0	0.00	18.45
2024	18.45	1.95	Max 2.5	0	0.00	18.45
2025	18.45	1.95	Max 2.5	0	0.00	18.45
2026	18.45	1.95	Max 2.5	0	0.00	18.45
2027	18.45	1.95	Max 2.5	0	0.00	18.45
2028	18.45	1.95	Max 2.5	0	0.00	18.45
2029	18.45	1.95	Max 2.5	0	0.00	18.45
2030	18.45	1.95	Max 2.5	0	0.00	18.45
* Inclusive of carve-outs						

Assumptions in VCE Model – 100% Renewable Energy Scenario

Year	MD Tier 1 RPS Requirement (%)	Solar (%)	Offshore Wind (MW)	Geothermal (%)	Tier 2 (%)	Total MD RPS Requirement (%)
2031	55.00	14.50	2,044	1.00	2.50	57.50
2032	60.00	14.50	2,044	1.00	2.50	62.50
2033	65.00	14.50	2,044	1.00	2.50	67.50
2034	70.00	14.50	2,044	1.00	2.50	72.50
2035	75.00	14.50	2,044	1.00	2.50	77.50
2036	80.00	14.50	2,044	1.00	2.50	82.50
2037	85.00	14.50	2,044	1.00	2.50	87.50
2038	90.00	14.50	2,044	1.00	2.50	92.50
2039	95.00	14.50	2,044	1.00	2.50	97.50
2040	97.50	14.50	2,044	1.00	2.50	100.00
* Inclusive of carve-outs						

Assumptions in VCE Model – 100% Clean Energy Scenario (CARES Act)

Year	Total (%)	Solar (%)	Offshore	Clean Energy
			Wind (MW)	Tier (%)
2022	58.1	8.5	0	3.3
2023	60.4	9.5	0	4.2
2024	62.7	10.5	270	5.0
2025	65.0	11.5	270	5.8
2026	67.5	12.5	2,044	6.7
2027	70.5	13.5	2,044	7.5
2028	72.5	14.5	2,044	8.3
2029	74.5	14.5	2,044	9.2
2030	75.0	14.5	2,044	10.0
2031	77.5	14.5	2,044	12.0
2032	80.0	14.5	2,044	14.0
2033	82.5	14.5	2,044	16.0
2034	85.0	14.5	2,044	18.0
2035	87.5	14.5	2,044	20.0
2036	90.0	14.5	2,044	22.0
2037	92.5	14.5	2,044	24.0
2038	95.0	14.5	2,044	26.0
2039	97.5	14.5	2,044	28.0
2040	100.0	14.5	2,044	30.0
* Inclusive of carve-outs				