2020 EORM Study: Storage and ELCC SAWG Presentation 11/19/2020

Prepared for Electric Reliability Council of Texas

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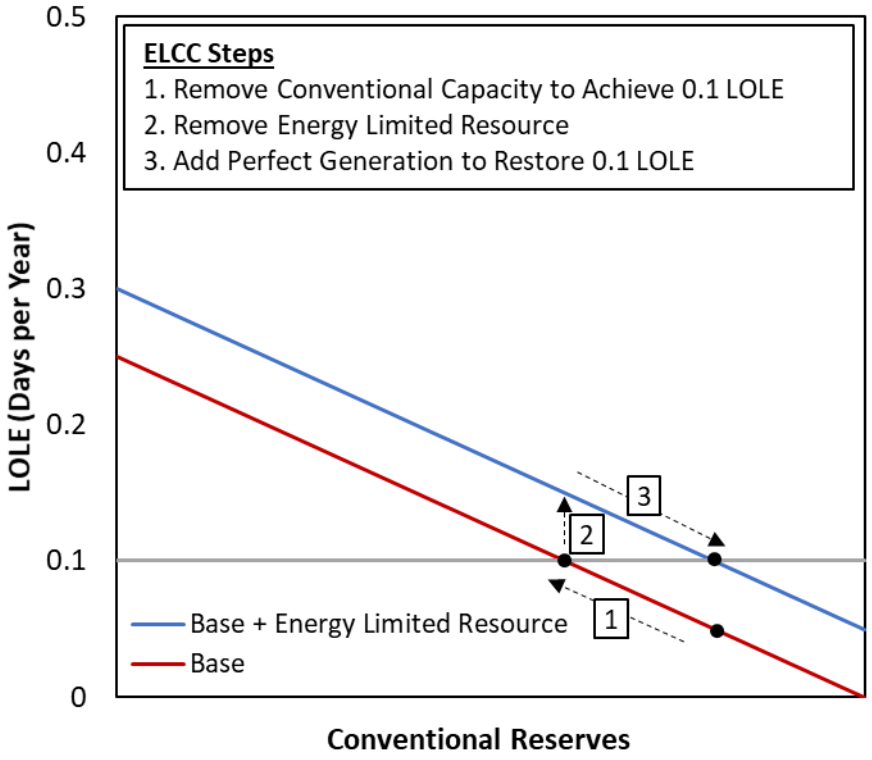
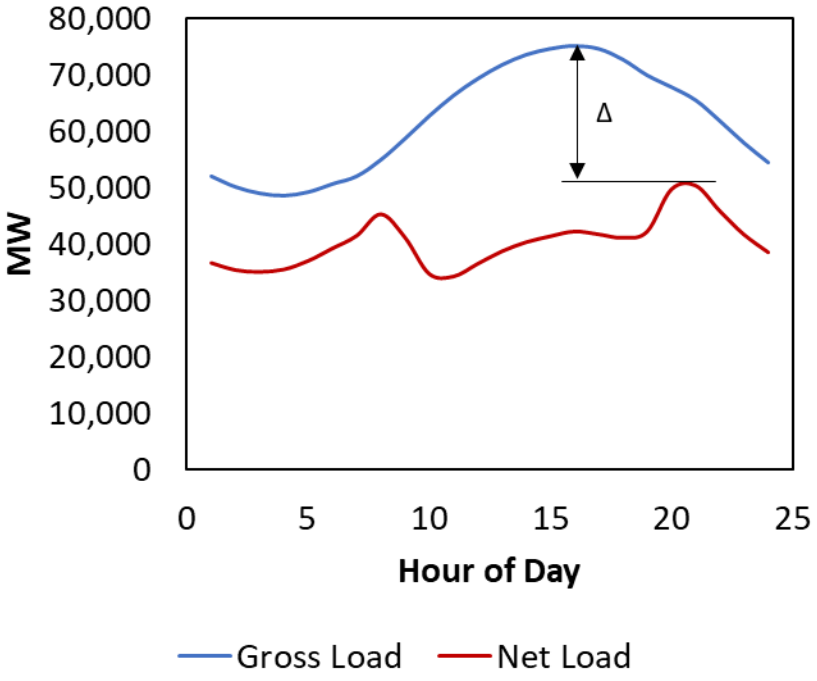
ELCC

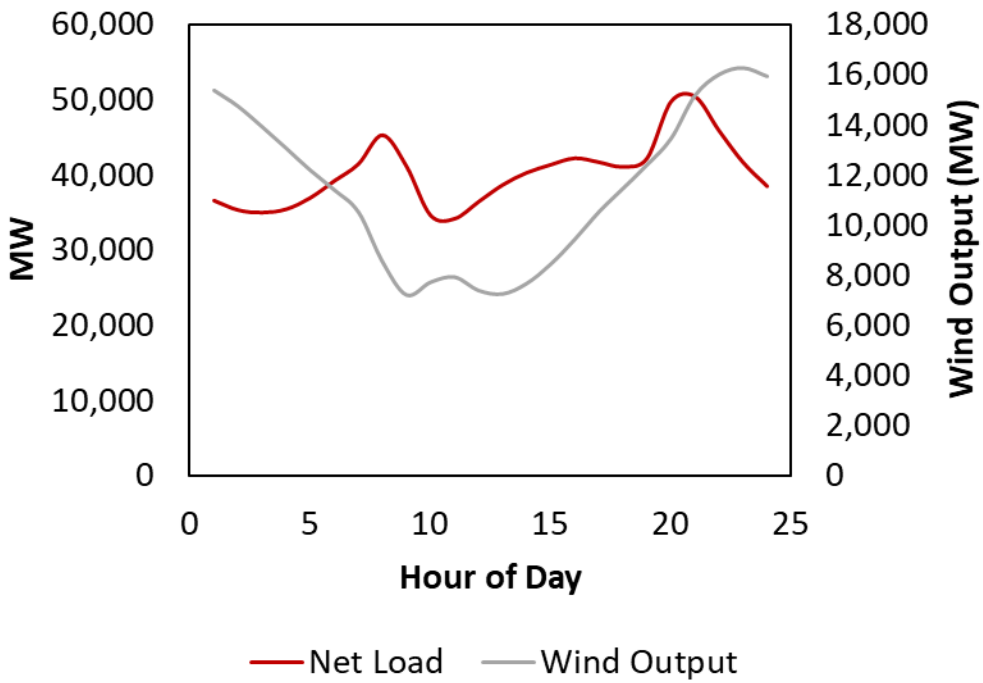
- **Capacity Value and ELCC are used interchangeably**



Average ELCC vs Incremental ELCC

- **Average ELCC**
  - Used for reserve margin accounting
  - Reduction in net load
- **Incremental ELCC**
  - Used for procurement
  - Expected output during net load peak





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Average ELCC vs Incremental ELCC

- **ERCOT Accounting Methodology**
  - Average output during top 20 gross load hours
  - Much higher than true reliability contribution

	Wind		Solar	
	Avg Output During Top 20 Load Hours	Net Load Reduction	Avg Output During Top 20 Load Hours	Net Load Reduction
2010	12%	8%	78%	75%
2011	24%	12%	83%	72%
2012	13%	6%	80%	72%
2013	24%	13%	82%	80%
2014	24%	16%	80%	68%
2015	18%	13%	81%	76%
2016	30%	21%	76%	71%
2017	24%	18%	75%	68%
2018	20%	16%	76%	70%
2019	27%	16%	79%	65%
Average	**22%**	**14%**	**79%**	**72%**

*Analysis was performed on the synthetic load, wind, and solar shapes

Average ELCC Calculations for ERCOT – All Renewable

- **Method:**
  - Remove all renewable
  - Add perfect generators to return LOLE to 0.1

	2020	2024	2024 High Renewable
All Renewable ELCC (MW)	9,436	18,693	22,844
All Renewable Installed Capacity (MW)	37,923	53,397	73,397
All Renewable ELCC (%)	25%	35%	31%

Average ELCC Calculations for ERCOT – Wind/Solar

- **Method:**
  - Remove all wind or all solar
  - Add perfect generators to return LOLE to 0.1

	2020	2024	2024 High Renewable
Wind Raw SERVM ELCC (MW)	5,422	7,045	9,194
Wind Installed Capacity (MW)	32,026	37,396	42,396
Wind ELCC (%)	17%	19%	22%

	2020	2024	2024 High Renewable
Solar Raw SERVM ELCC (MW)	4,711	12,529	17,095
Solar Installed Capacity (MW)	5,897	16,001	31,002
Solar ELCC (%)	80%	78%	55%

ELCC Allocation Methodology

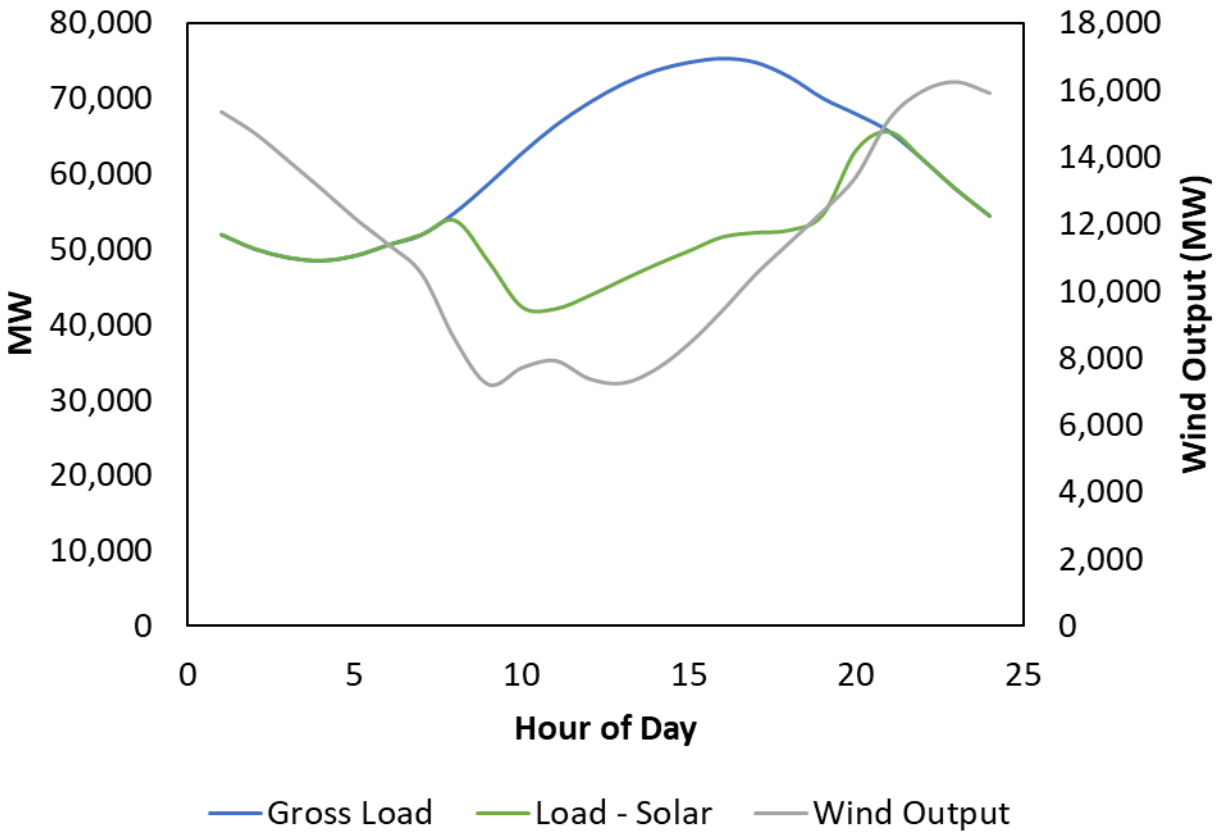
- **Wind ELCC + Solar ELCC <> All Renewable ELCC**
  - Wind ELCC = Wind ELCC / (Wind ELCC + Solar ELCC) * Renewable ELCC
  - Solar ELCC = Solar ELCC / (Wind ELCC + Solar ELCC) * Renewable ELCC

	2020	2024	2024 High Renewable
Wind Raw SERVM ELCC (MW)	5,422	7,045	9,194
Wind Allocated ELCC (MW)	5,049	6,728	7,989
Wind ELCC (%)	16%	18%	19%

	2020	2024	2024 High Renewable
Solar Raw SERVM ELCC (MW)	4,711	12,529	17,095
Solar Allocated ELCC (MW)	4,387	11,965	14,855
Solar ELCC (%)	74%	75%	48%

Wind and Solar ELCC Interactions

- **High solar penetration shifts net load to evening hours when wind output is higher**



Zonal ELCCs

- **Similar method for zonal ELCCs**
  - Sum of zonal by technology allocated to equal the total technology MW

	May 2020 CDR Summer Peak Average Capacity Contribution	2020	2024	2024 High Renewable
Wind-C	63%	31%	37%	24%
Wind-O	16%	11%	13%	18%
Wind-P	29%	21%	22%	17%
All Wind		16%	18%	19%

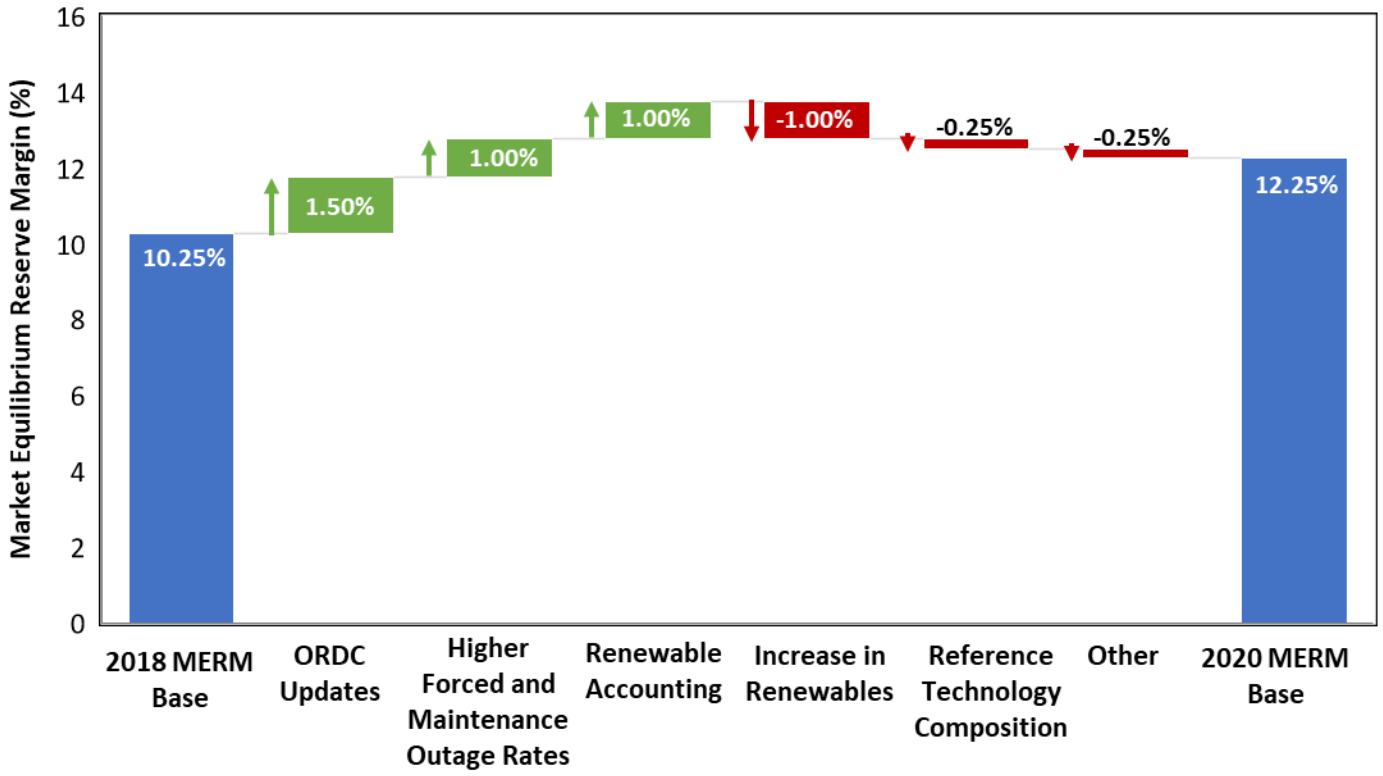
	May 2020 CDR Summer Peak Average Capacity Contribution	2020	2024	2024 High Renewable
Solar Non-West	76%	71%	72%	46%
Solar West	76%	75%	76%	49%
All Solar		74%	75%	48%

ELCC Impact on MERM

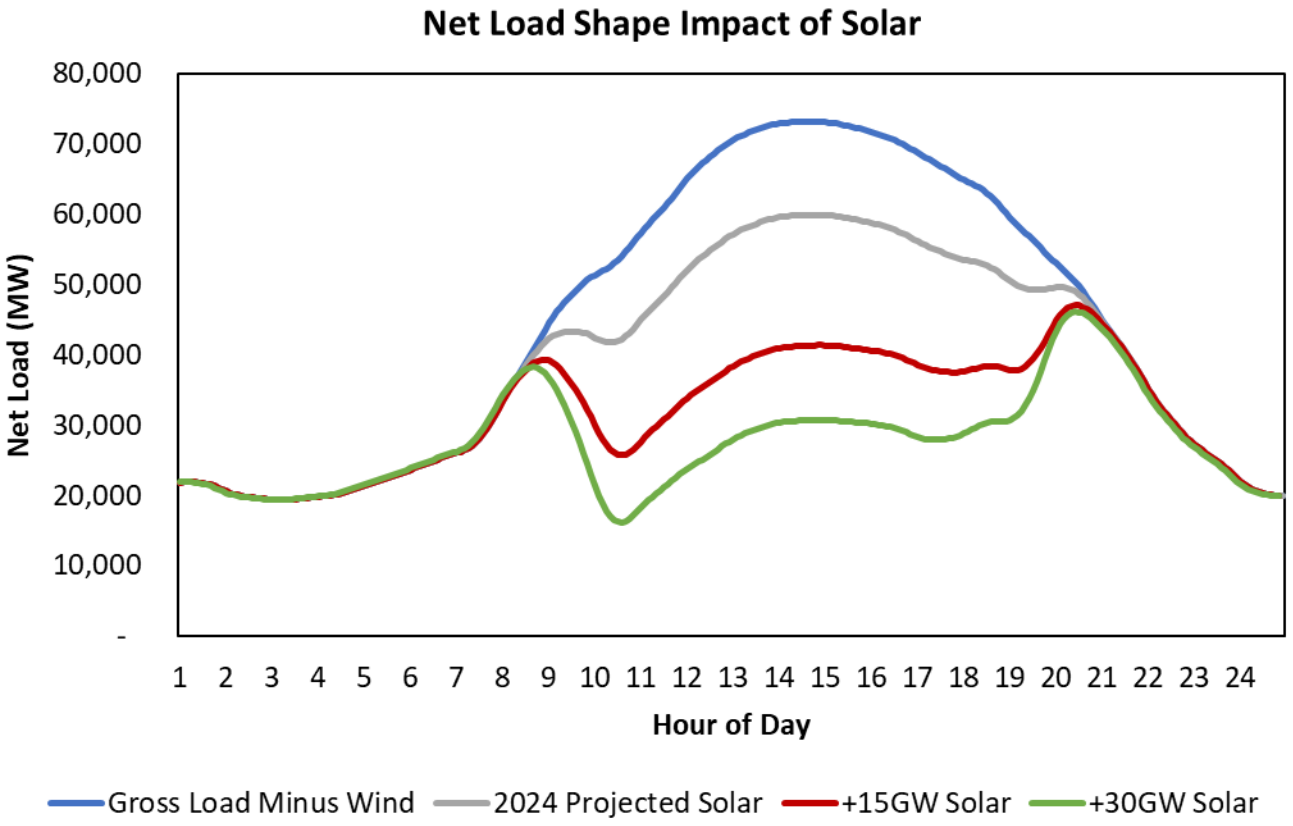
	2018	2020	Delta
Wind CDR Capacity Credit (MW)	6,331	9,137	2,806
Wind Net Load Benefit (MW)	5,590	6,731	1,142

Capacity Need Impact (MW)	1,664
0.1 LOLE RM Impact (%)	2.1%
Storage RM Impact (%)	1.1%
RM Accounting Impact on MERM (%)	1.0%

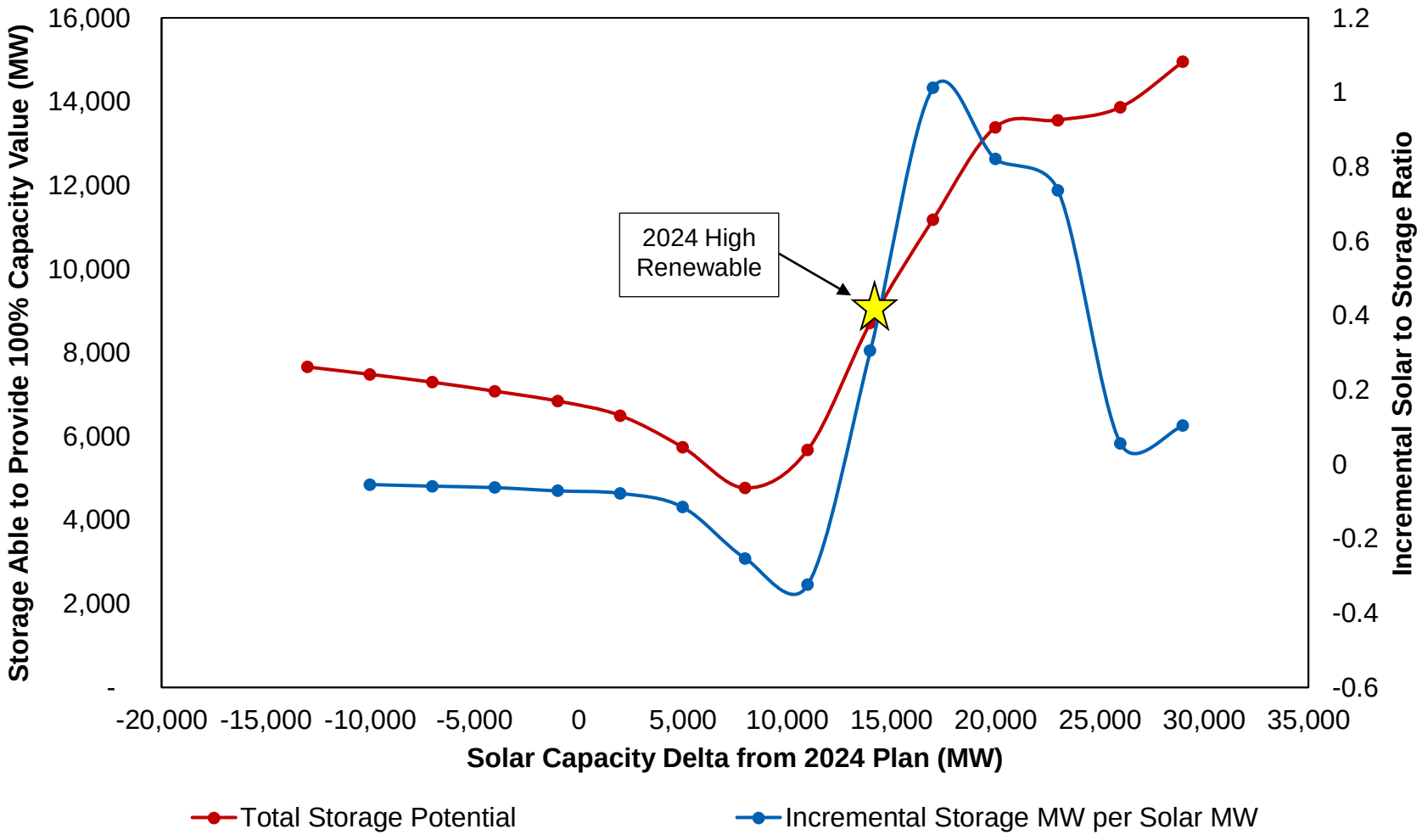
MERM Waterfall



Storage Analysis



Storage Capacity Potential



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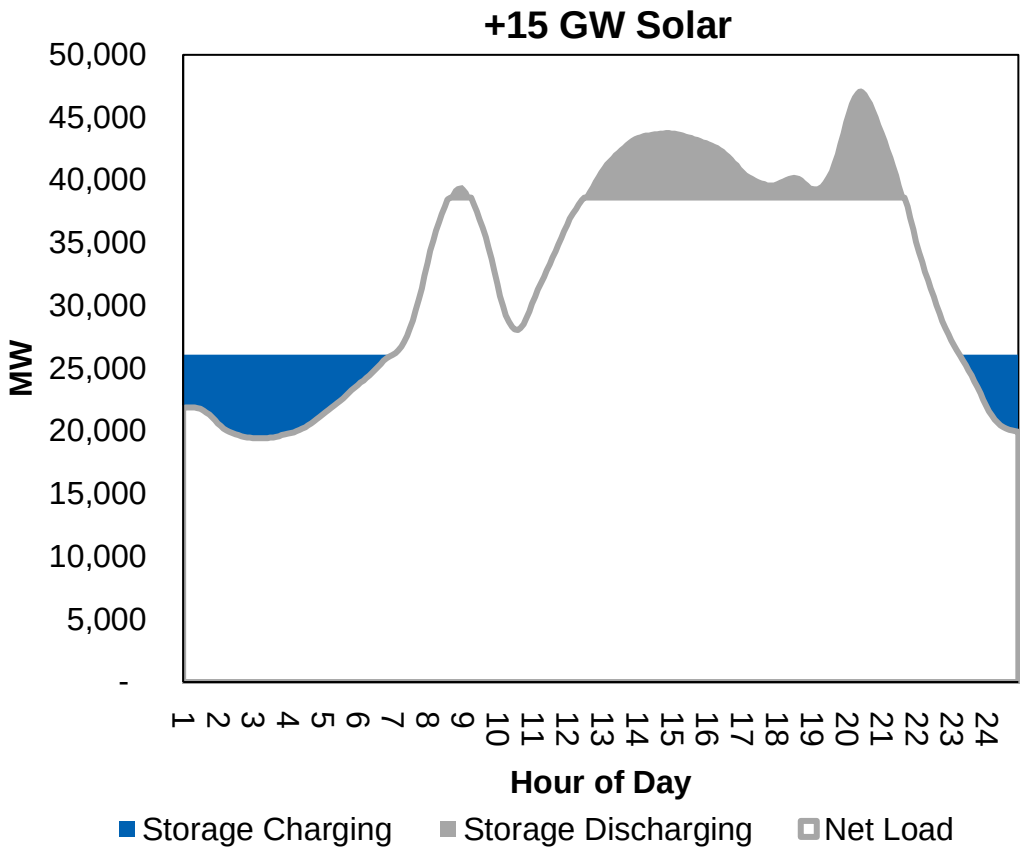
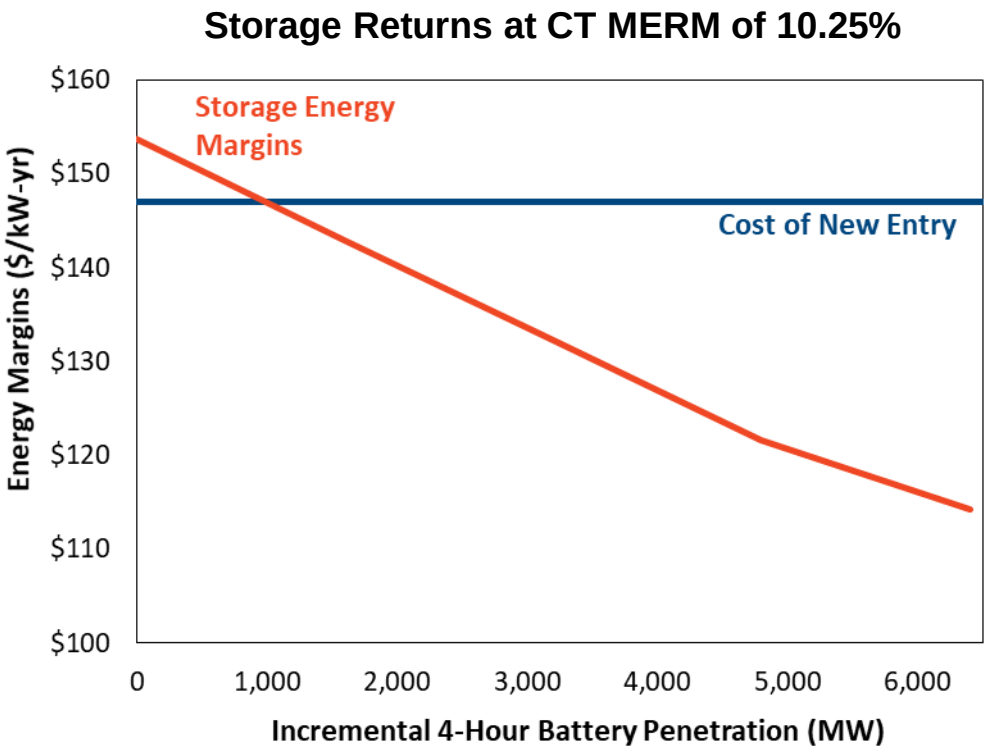
Storage Value Streams

- **A/S**
  - Declines rapidly with penetration
- **Energy Arbitrage**
  - Declines with penetration
- **Capacity**
  - Similar opportunity to CT



Storage Potential

- **Storage Modeling Uncertainty**
  - Market pricing uncertainty (How will bidding behaviors change at high renewable penetration?)
  - Incremental A/S opportunity for storage
  - Congestion/other effects not quantified



Sensitivity Results

Scenario/Sensitivity	MERM (%)	EORM (%)
Base Case	**12.25**	**11.00**
Vary Gross CONE	11.50 - 13.00	10.25 - 12.75
Vary VOLL	12.25	10.25 - 13.25
Vary Probability of Weather Years	13.25	12.50
Vary Forward Period and Load Forecast Uncertainty	11.25 - 12.00	10.00 - 10.75
High Renewables Scenario	**10.25**	**9.00**
EFOR	**11.25**	**10.00**