The impact of future deployments of renewable energy on local wholesale electricity prices and bills in ERCOT

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IdeaSmiths LLC

IdeaSmiths LLC is a consulting firm that specializes in energy systems analysis and the evaluation of novel energy technologies.

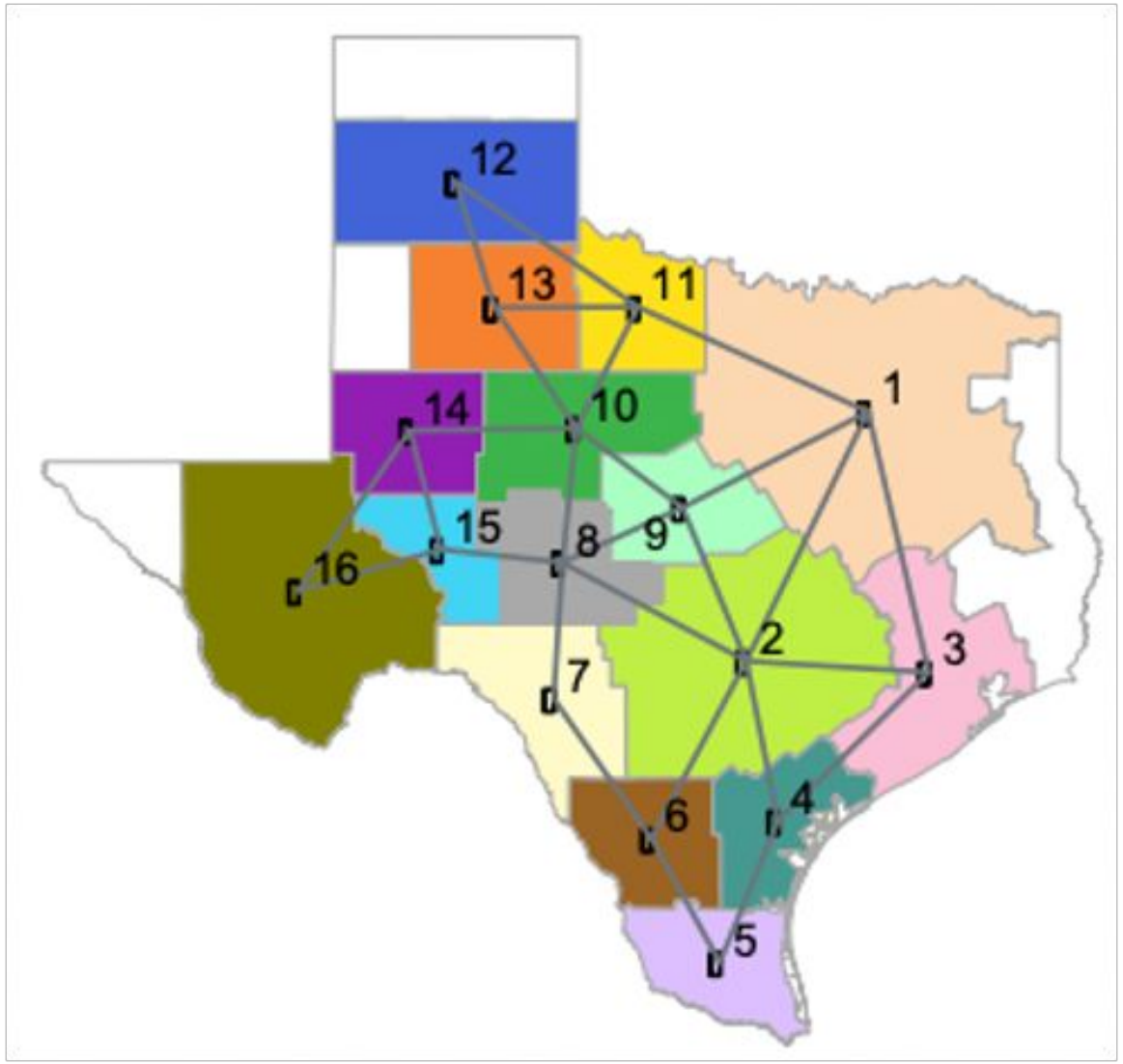
Renewable Energy Savings Takeaways in Texas (ERCOT)

- In total, we estimate that not allowing renewables past 2025 would result in about $115 billion higher wholesale market costs in ERCOT between 2025 and 2040.
- Across all regions, we estimate that renewables would reduce energy costs by about 12% for commercial customers.
    - For a relatively small business that uses 5,000 kilowatt-hours of electricity every month, that's a savings of more than $625 every year from 2025-2040.
    - For a larger manufacturer using 100,000 kilowatt-hours of electricity each month, renewables result in an average savings of about $12,450 per year between 2025 and 2040.

Regional renewable energy savings

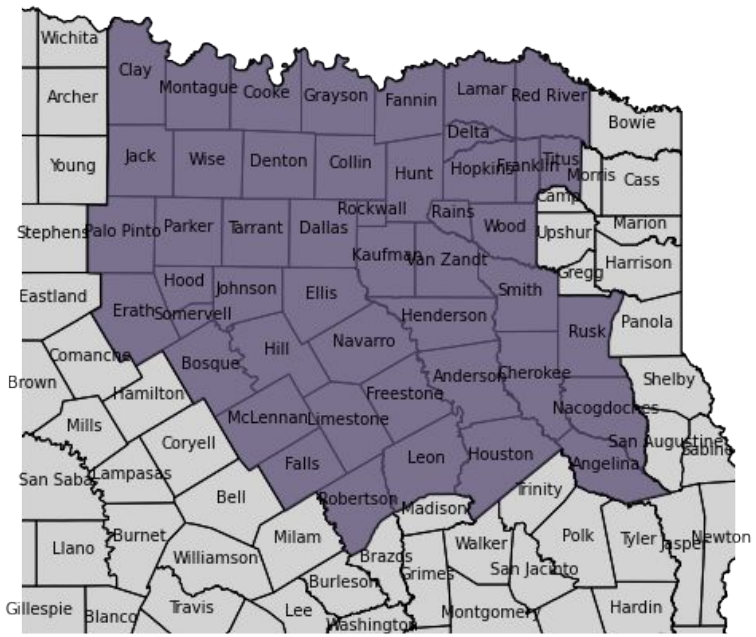
This analysis considered the impacts of future deployments of renewable energy across Texas regions

Zone	Area
1	Dallas
2	San Antonio
3	Houston
4	Corpus Christi
5	McAllen
6	Laredo
7	Del Rio
8	San Angelo
9	San Saba
10	Abilene
11	Wichita Falls
12	Amarillo
13	Lubbock
14	Midland
15	Fort Stockton
16	Pecos

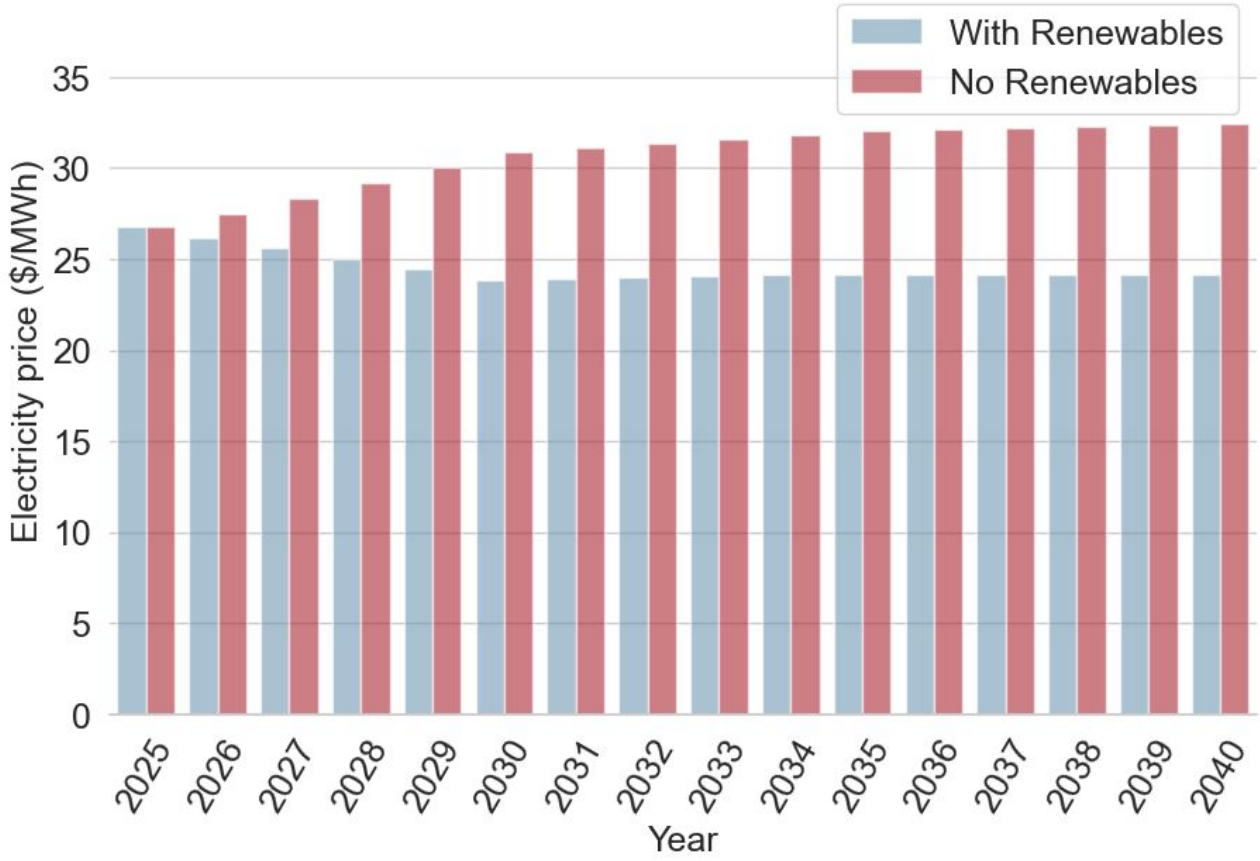


In Zone 1, we estimate that, with renewables, future average wholesale electricity costs will be about $6.62/MWh lower

Counties in Zone 1

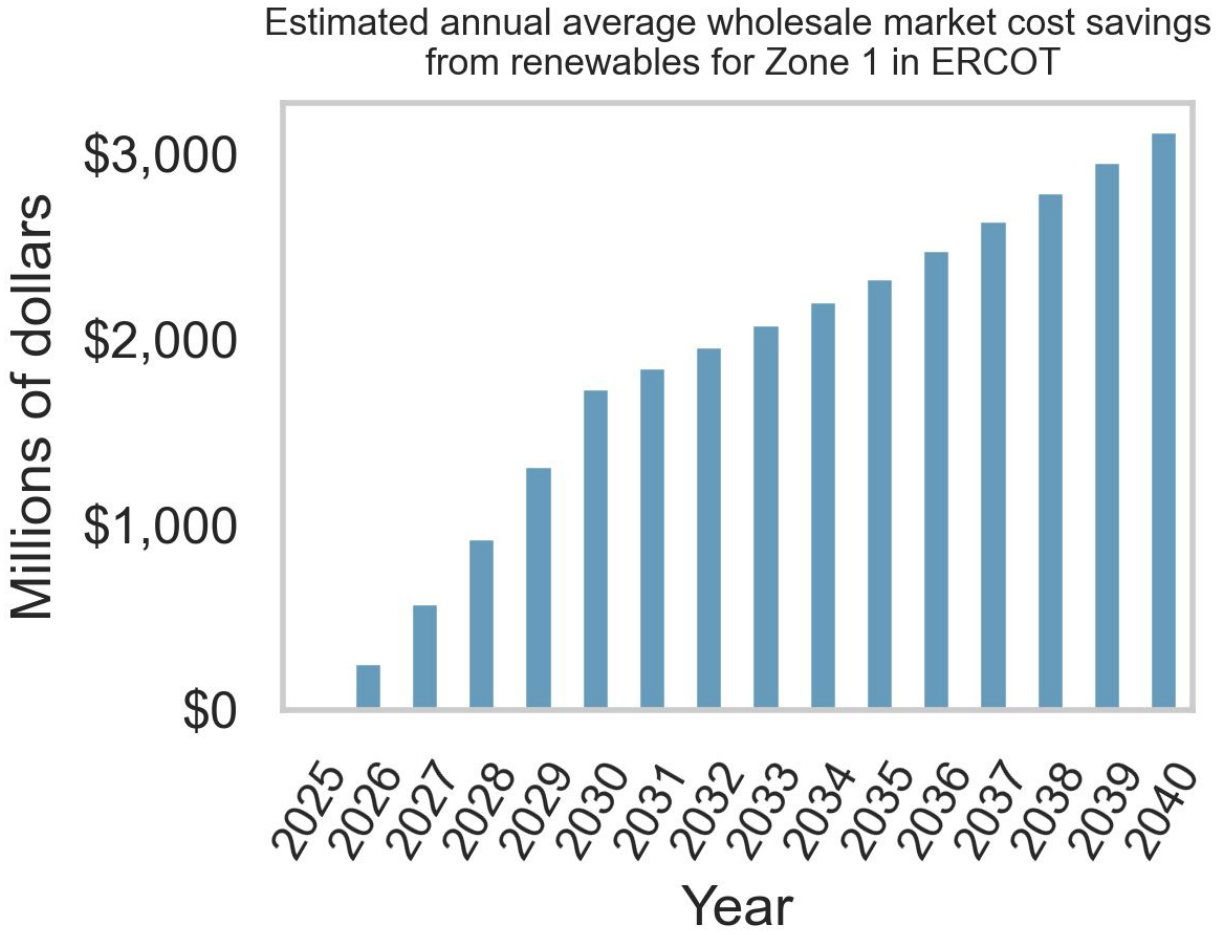


Estimated annual average wholesale market cost differences with and without renewables for Zone 1 in ERCOT

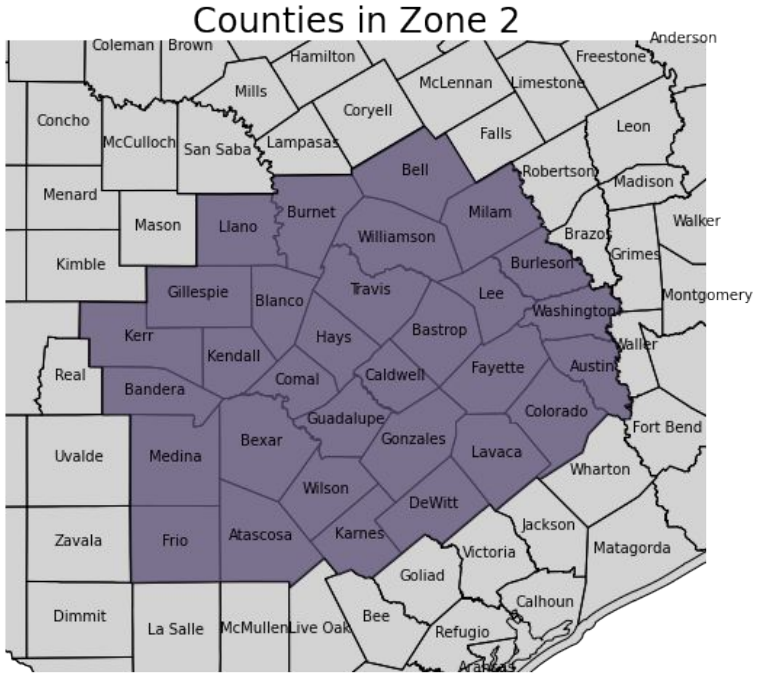


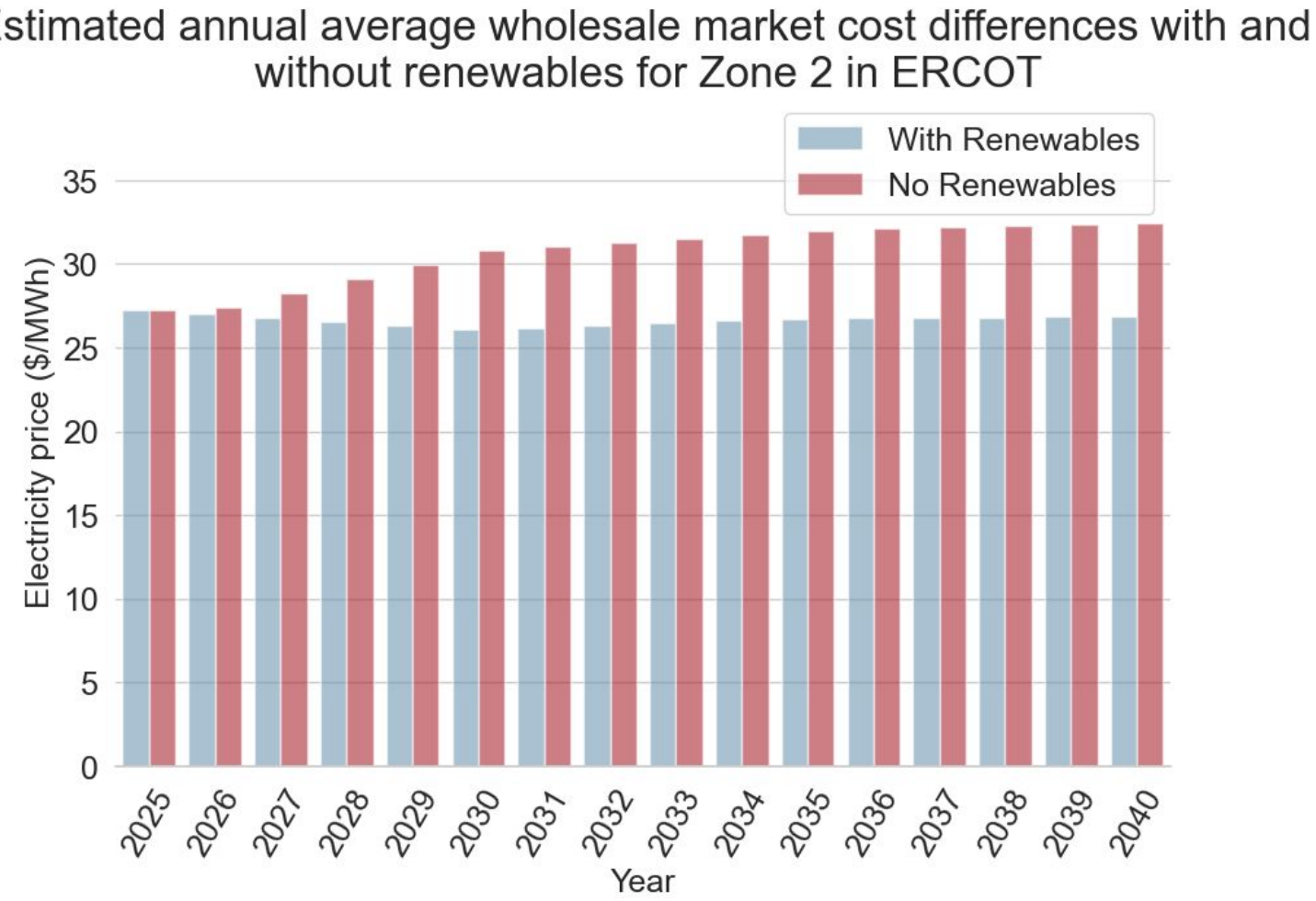
In Zone 1, we estimate that renewables will reduce total electricity wholesale market costs by about $29B between 2025-2040 and save commercial customers about 8% on electricity rates over the next 15 years

Average monthly electricity use (kWh)	Average annual savings over the next 15 years ($)
1,000	$79.47
5,000	$397.35
10,000	$794.70
100,000	$7,947.04



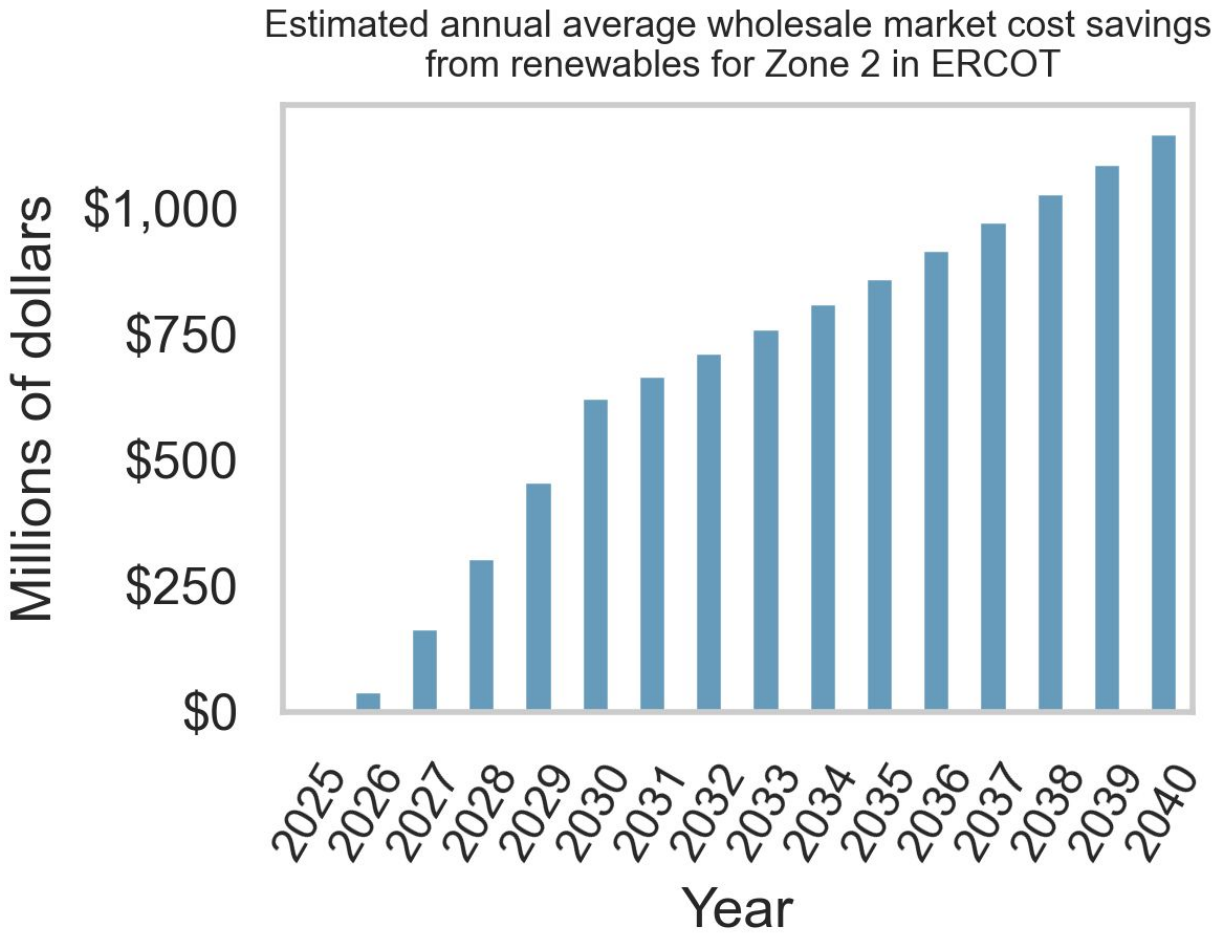
In Zone 2, we estimate that, with renewables, future average wholesale electricity costs will be about $4.35/MWh lower



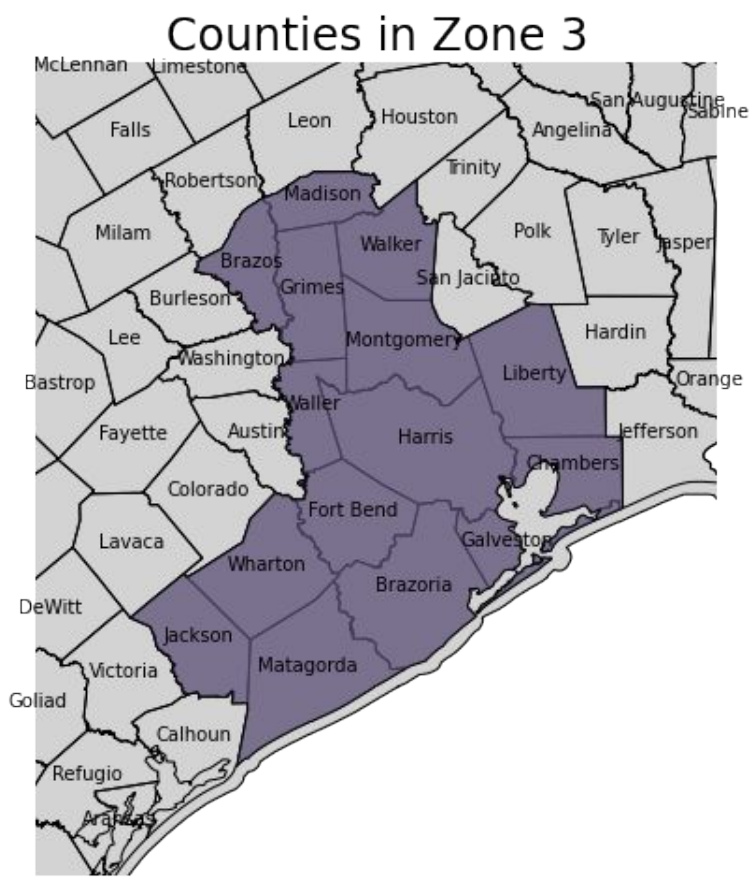


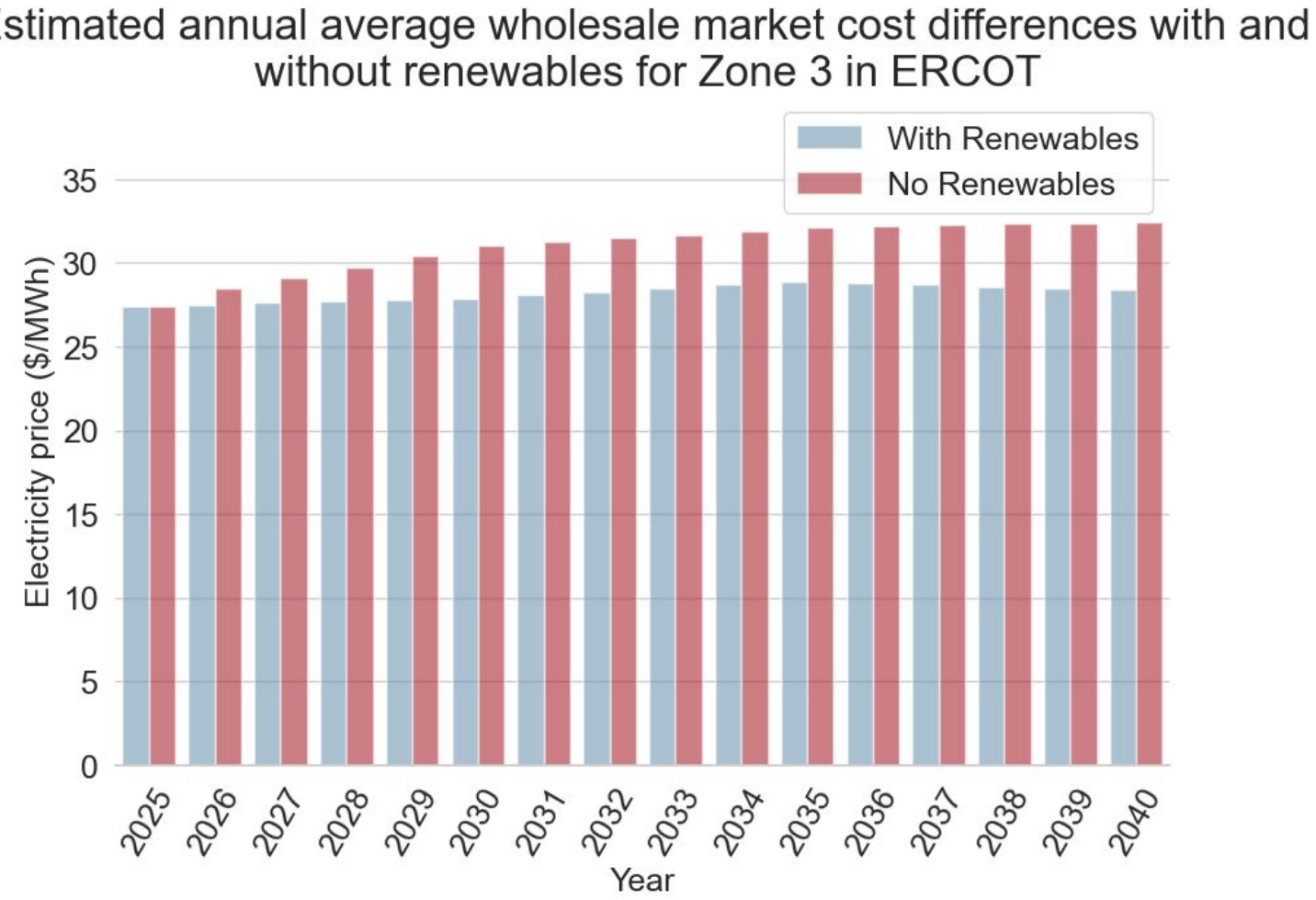
In Zone 2, we estimate that renewables will reduce total electricity wholesale market costs by about $11B between 2025-2040 and save commercial customers about 5% on electricity rates over the next 15 years

Average monthly electricity use (kWh)	Average annual savings over the next 15 years ($)
1,000	$ 52.17
5,000	$ 260.86
10,000	$ 521.72
100,000	$ 5,217.16



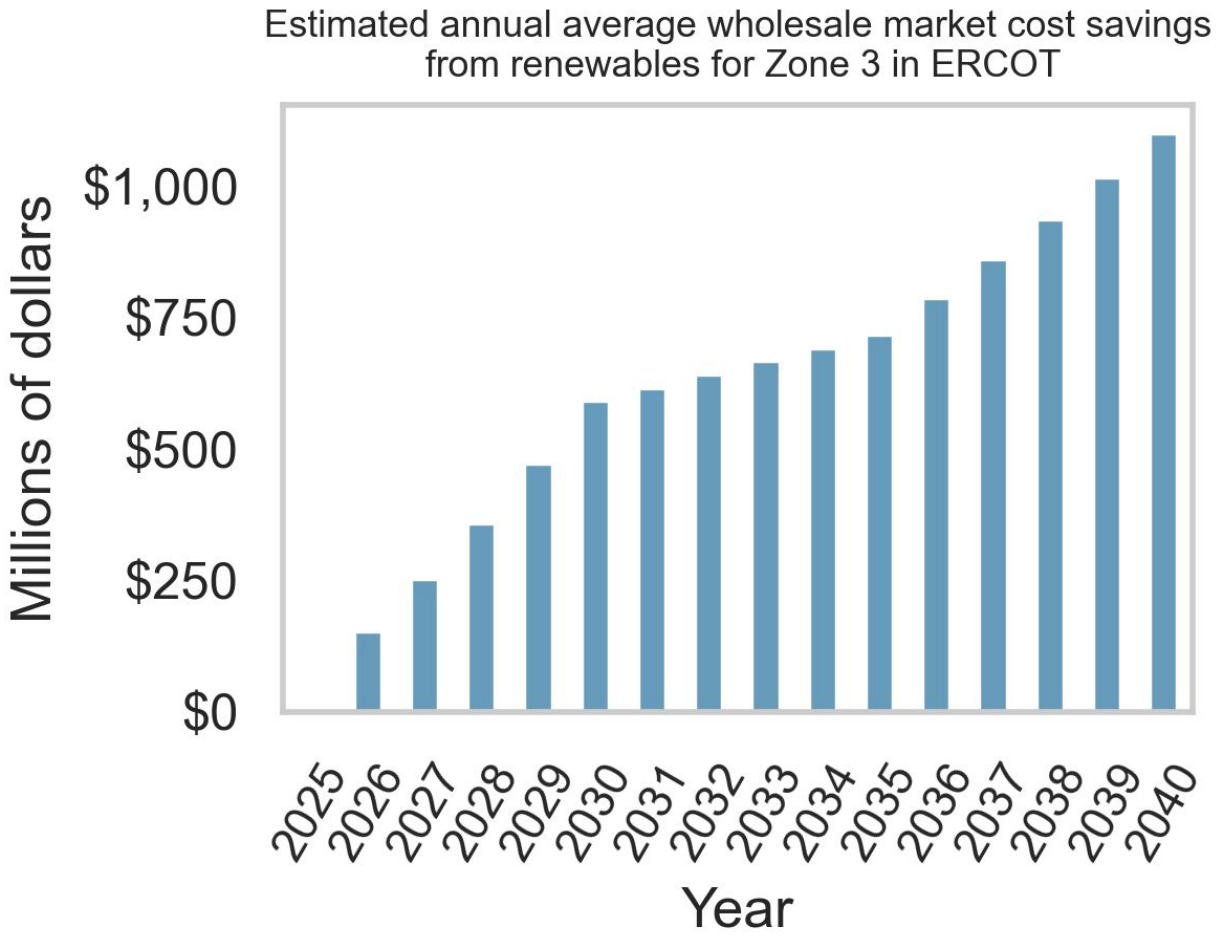
In Zone 3, we estimate that, with renewables, future average wholesale electricity costs will be about $3.00/MWh lower



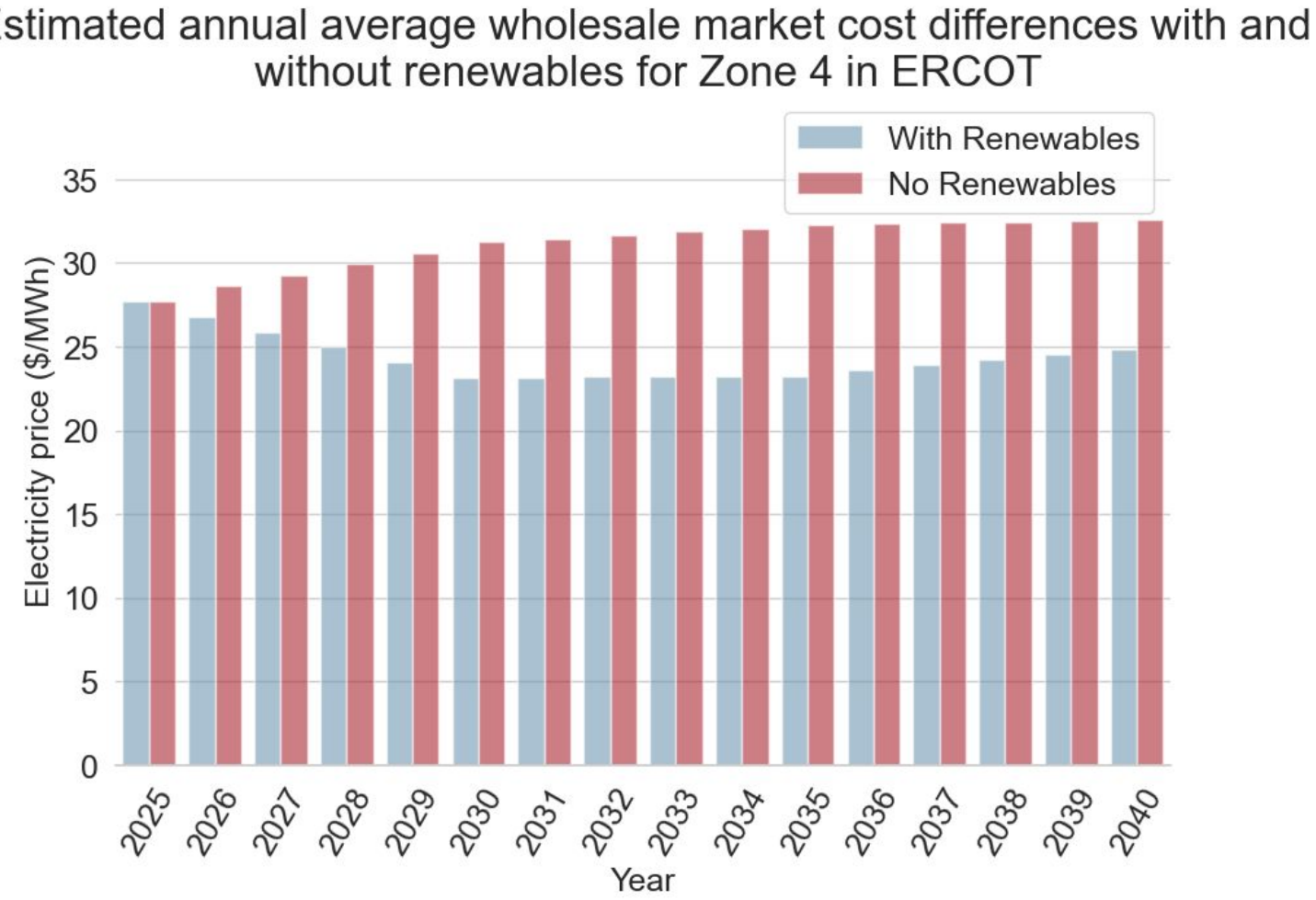


In Zone 3, we estimate that renewables will reduce total electricity wholesale market costs by about $10B between 2025-2040 and save commercial customers about 4% on electricity rates over the next 15 years

Average monthly electricity use (kWh)	Average annual savings over the next 15 years ($)
1,000	$ 35.97
5,000	$ 179.87
10,000	$ 359.74
100,000	$ 3,597.44



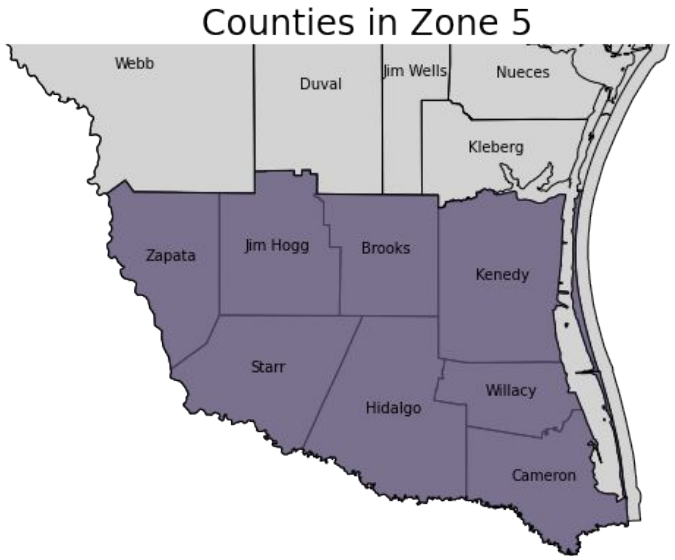
In Zone 4, we estimate that, with renewables, future average wholesale electricity costs will be about $7.30/MWh lower

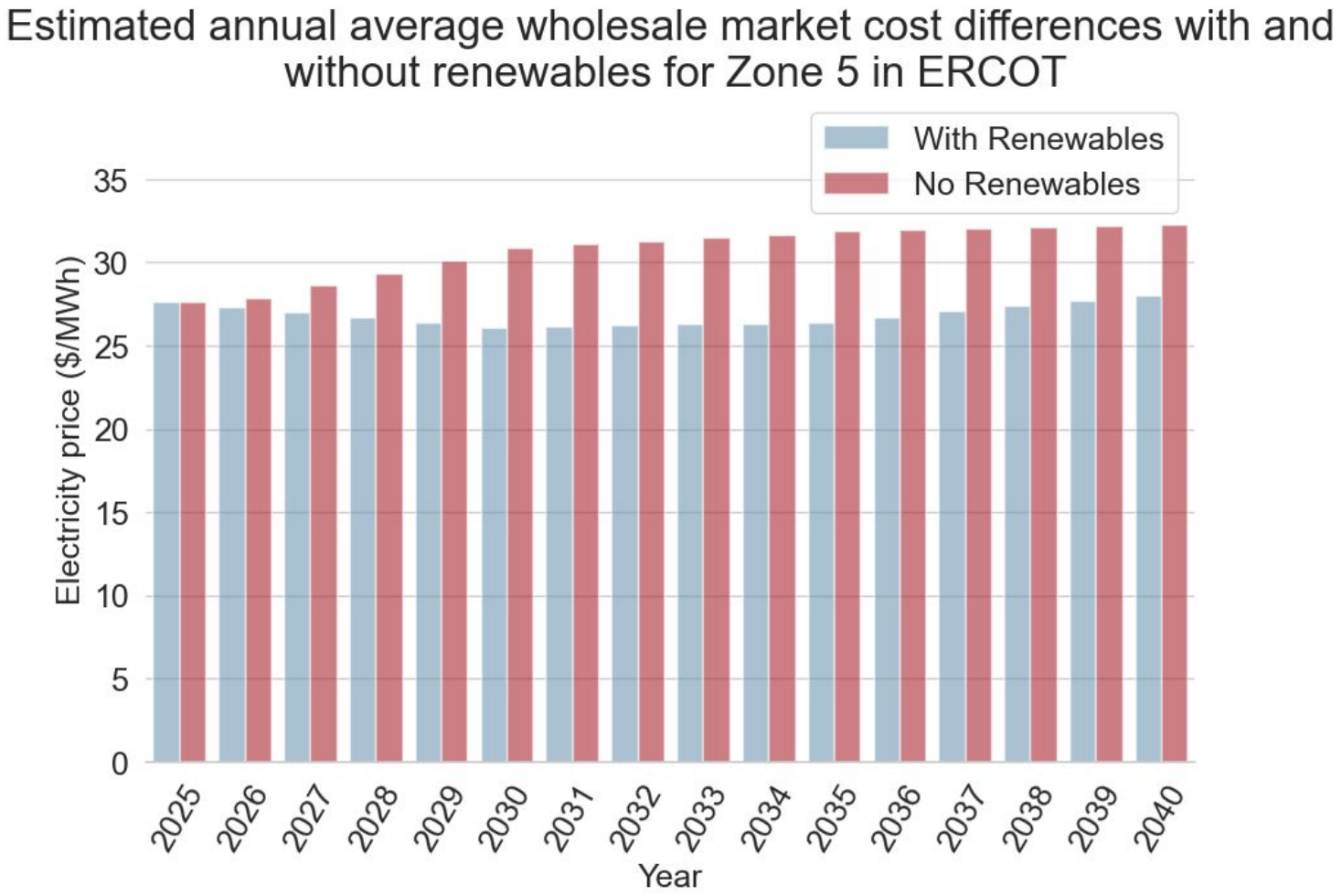


In Zone 4, we estimate that renewables will reduce total electricity wholesale market costs by about $4B between 2025-2040 and save commercial customers about 9% on electricity rates over the next 15 years

Average monthly electricity use (kWh)	Average annual savings over the next 15 years ($)
1,000	$ 87.59
5,000	$ 437.94
10,000	$ 875.88
100,000	$ 8,758.79

In Zone 5, we estimate that, with renewables, future average wholesale electricity costs will be about $4.20/MWh lower

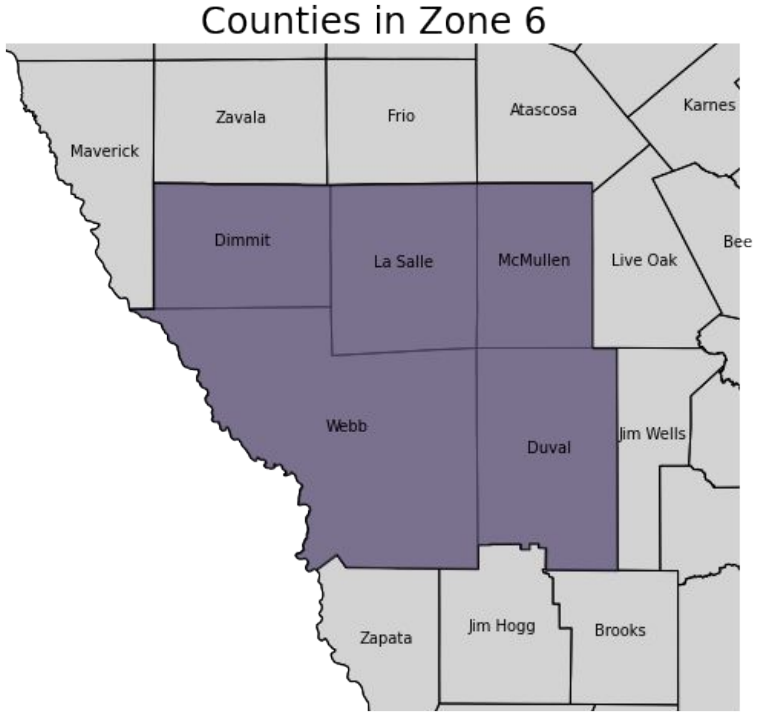


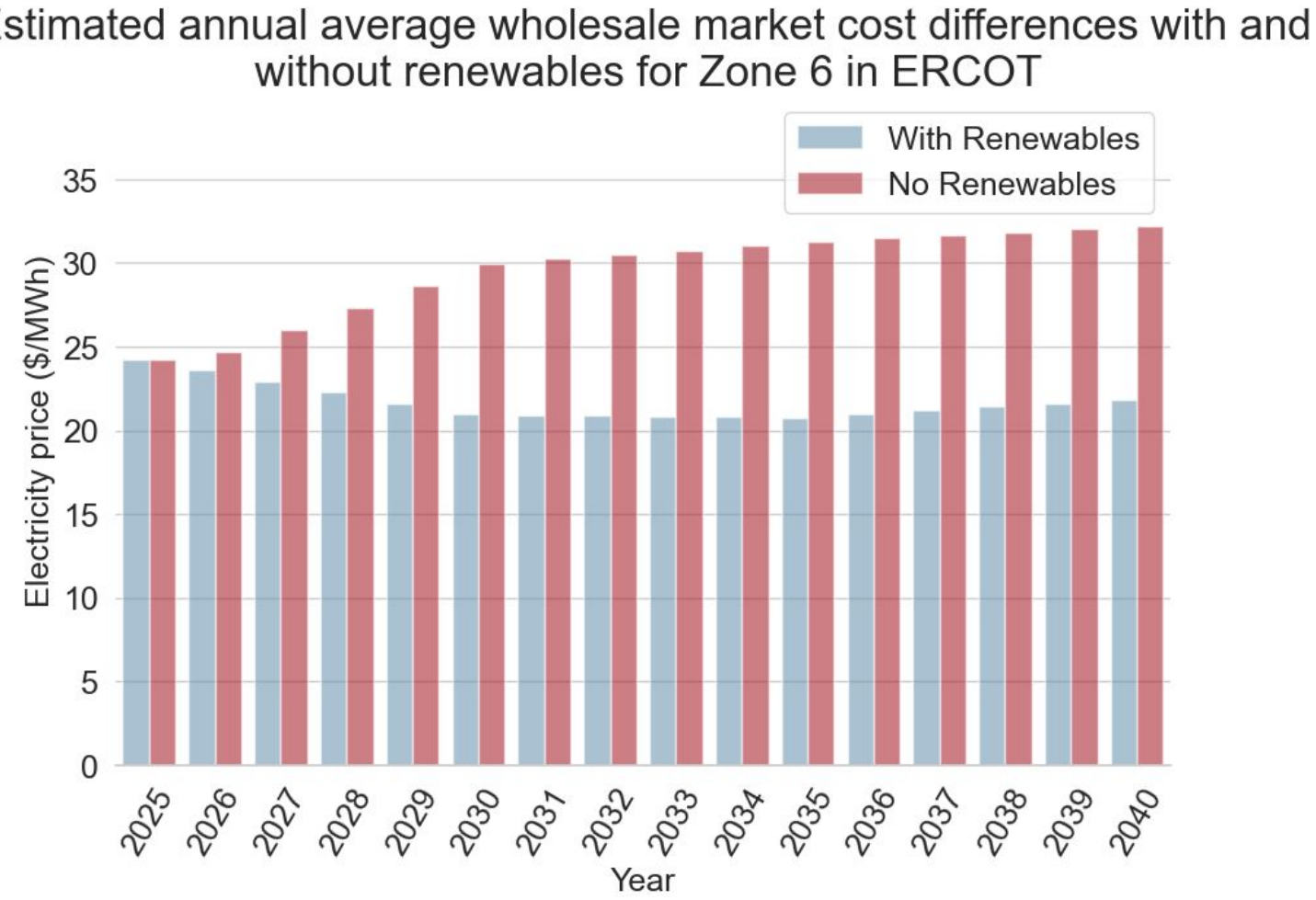


In Zone 5, we estimate that renewables will reduce total electricity wholesale market costs by about $5B between 2025-2040 and save commercial customers about 5% on electricity rates over the next 15 years

Average monthly electricity use (kWh)	Average annual savings over the next 15 years ($)
1,000	$ 50.44
5,000	$ 252.20
10,000	$ 504.39
100,000	$ 5,043.94

In Zone 6, we estimate that, with renewables, future average wholesale electricity costs will be about $8.47/MWh lower

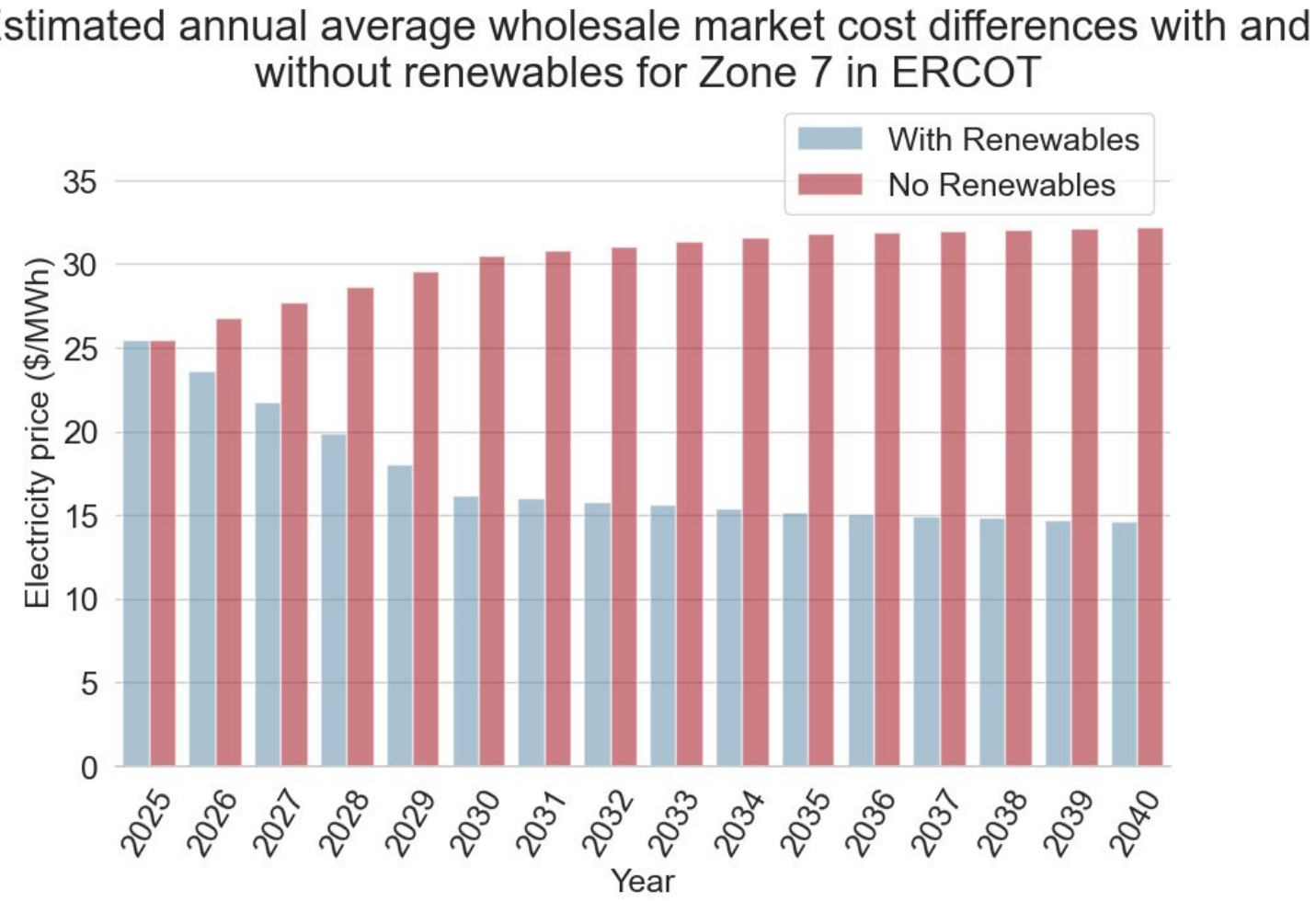




In Zone 6, we estimate that renewables will reduce total electricity wholesale market costs by about $2B between 2025-2040 and save commercial customers about 10% on electricity rates over the next 15 years

Average monthly electricity use (kWh)	Average annual savings over the next 15 years ($)
1,000	$ 101.70
5,000	$ 508.50
10,000	$ 1,017.00
100,000	$ 10,169.96

In Zone 7, we estimate that, with renewables, future average wholesale electricity costs will be about $13.91/MWh lower

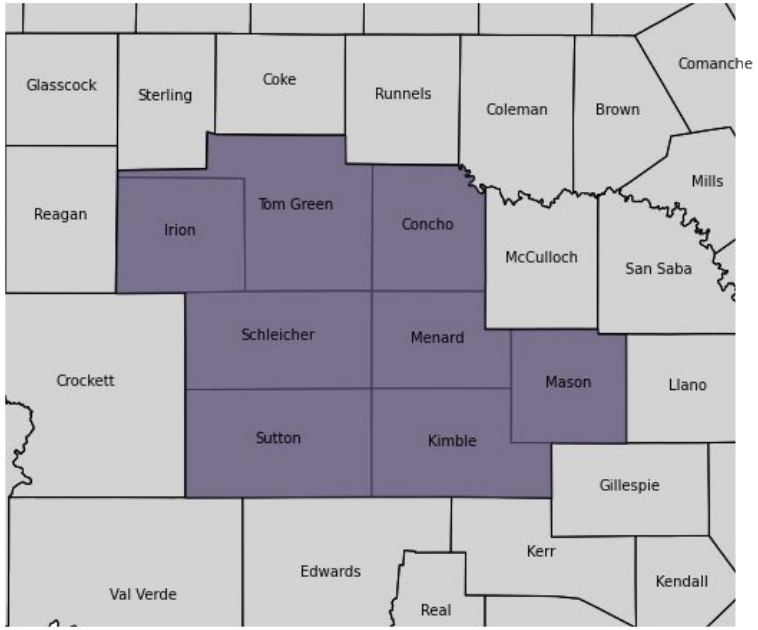


In Zone 7, we estimate that renewables will reduce total electricity wholesale market costs by about $1.2B between 2025-2040 and save commercial customers about 17% on electricity rates over the next 15 years

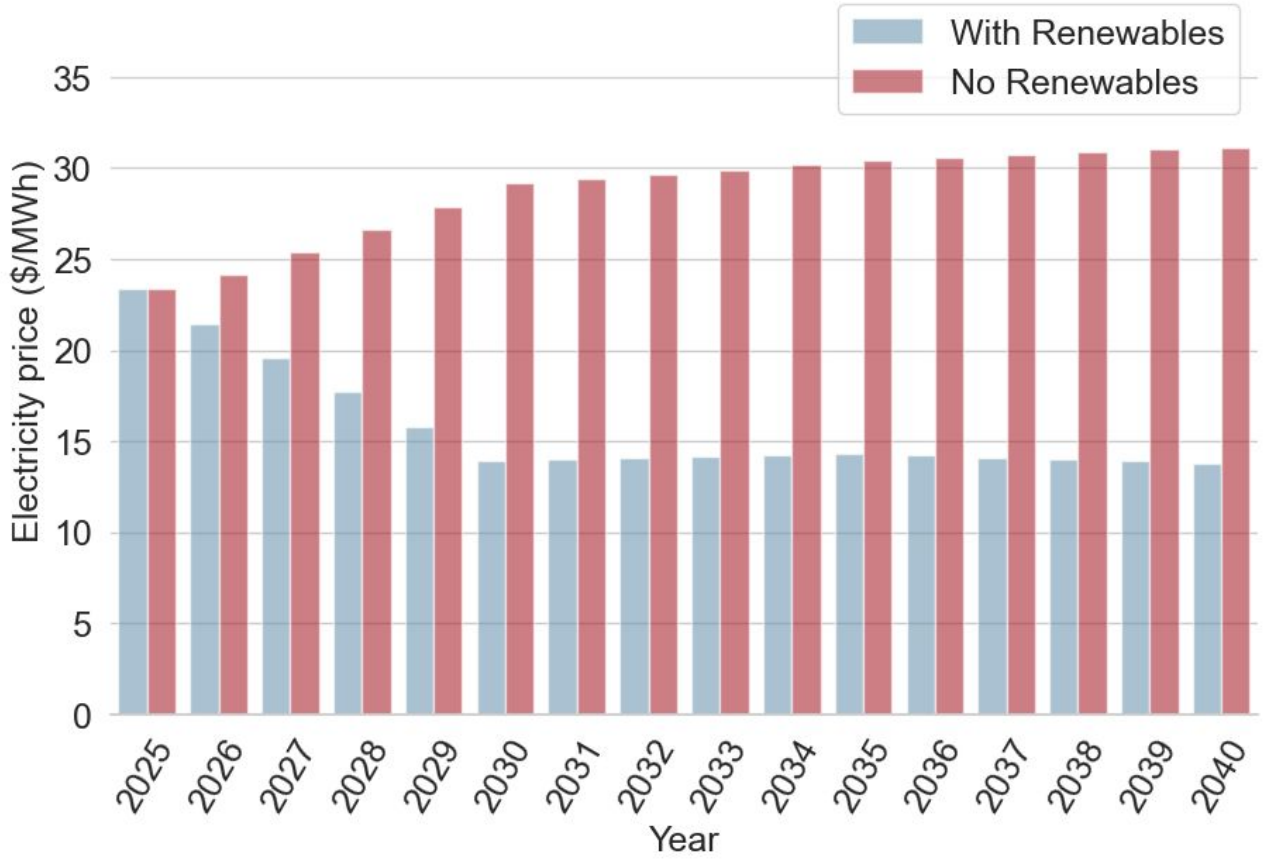
Average monthly electricity use (kWh)	Average annual savings over the next 15 years ($)
1,000	$ 166.88
5,000	$ 834.42
10,000	$ 1,668.85
100,000	$ 16,688.46

In Zone 8, we estimate that, with renewables, future average wholesale electricity costs will be about $13.86/MWh lower

Counties in Zone 8

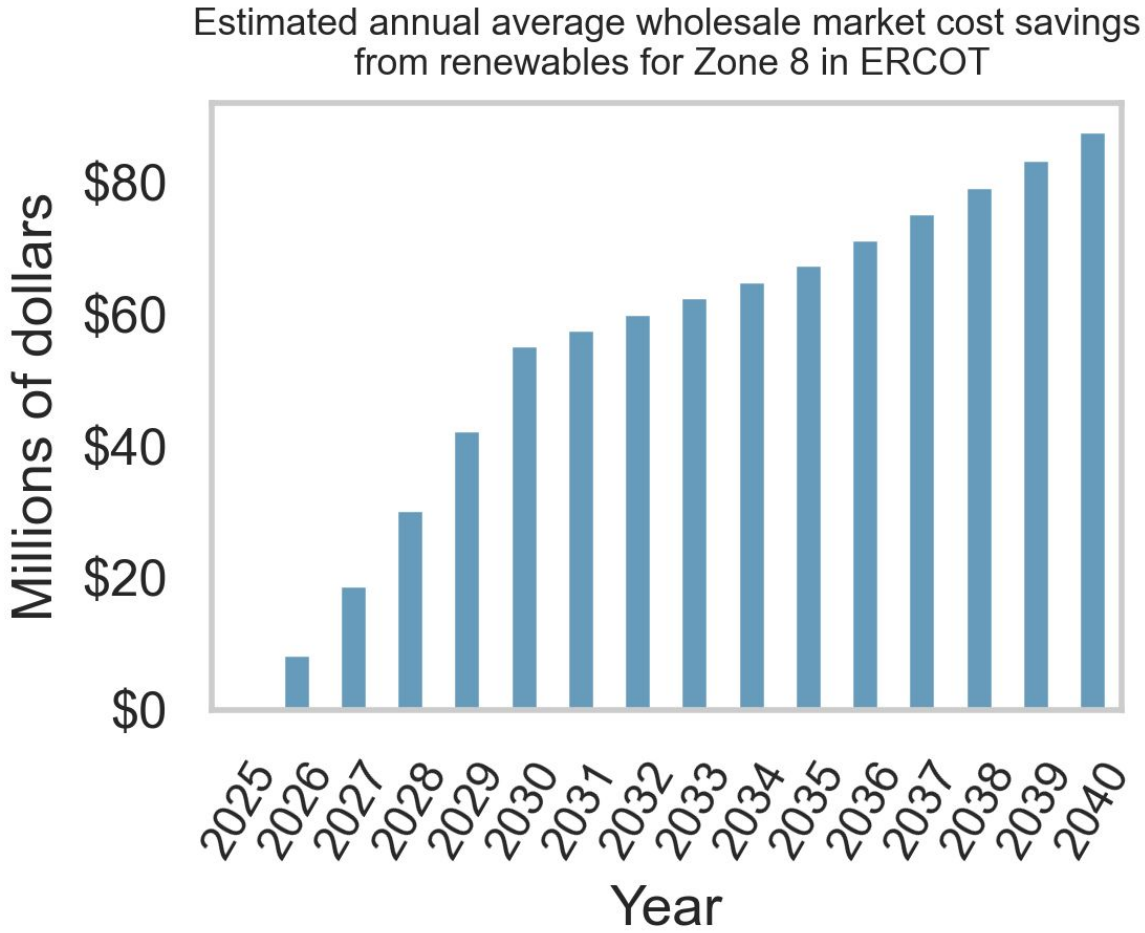


Estimated annual average wholesale market cost differences with and without renewables for Zone 8 in ERCOT

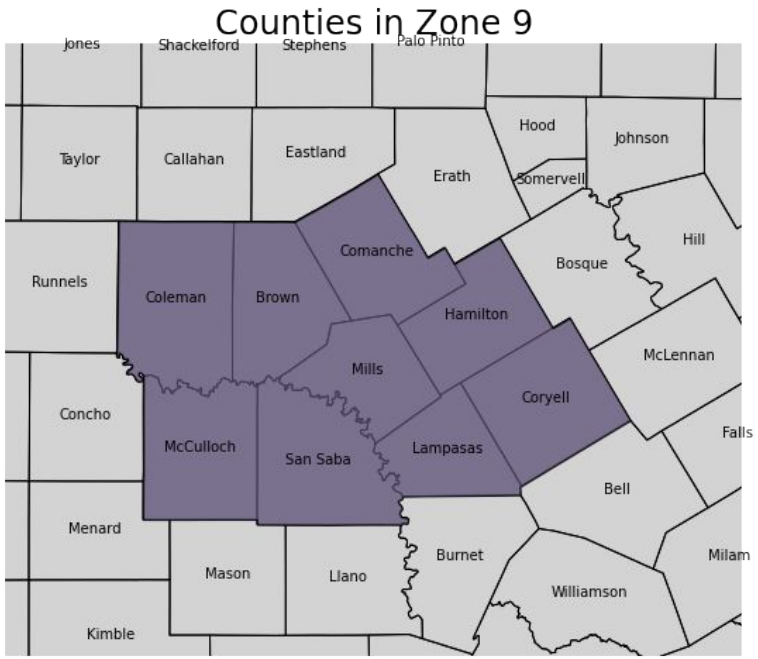


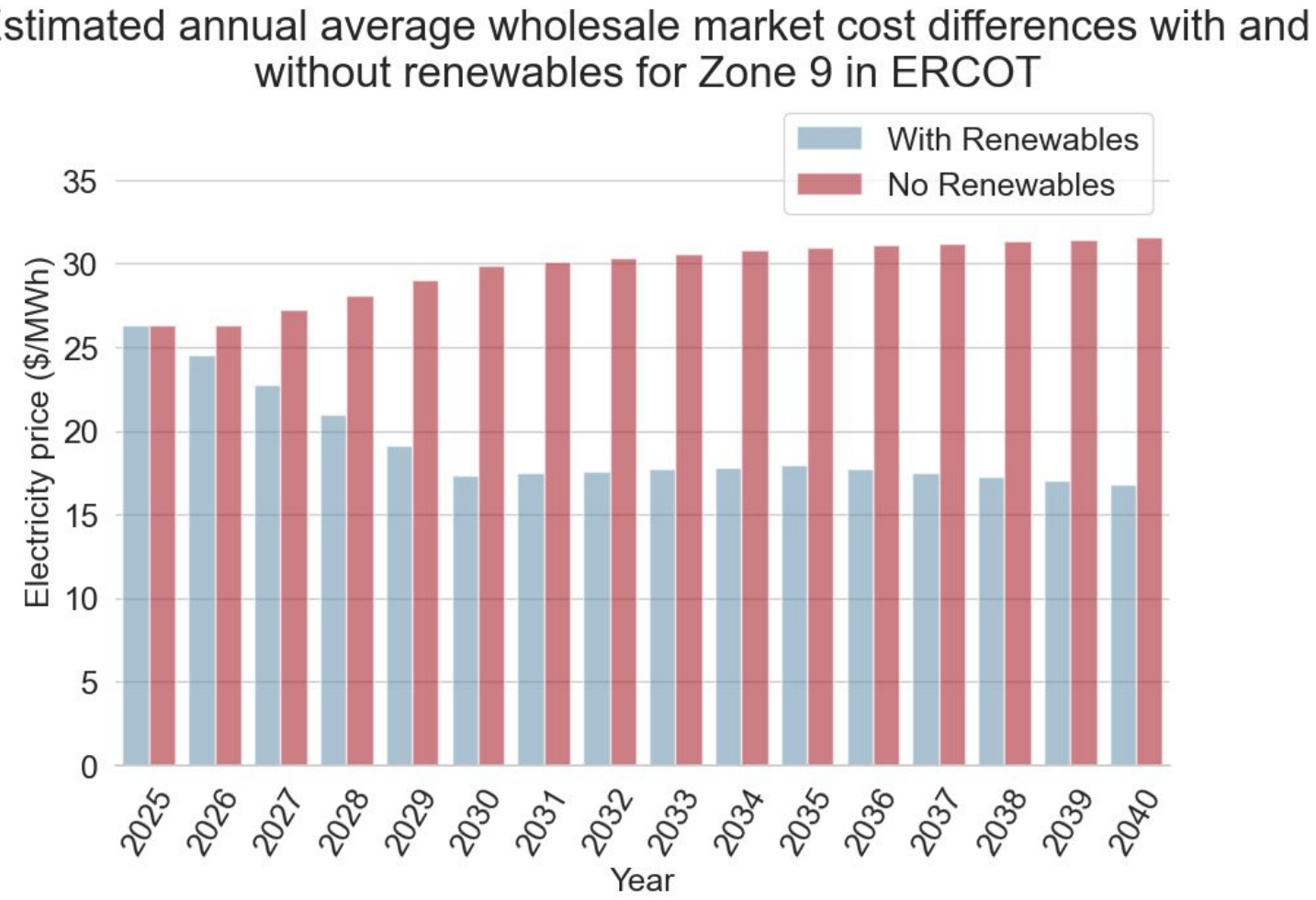
In Zone 8, we estimate that renewables will reduce total electricity wholesale market costs by about $1B between 2025-2040 and save commercial customers about 17% on electricity rates over the next 15 years

Average monthly electricity use (kWh)	Average annual savings over the next 15 years ($)
1,000	$ 166.31
5,000	$ 831.56
10,000	$ 1,663.12
100,000	$ 16,631.17



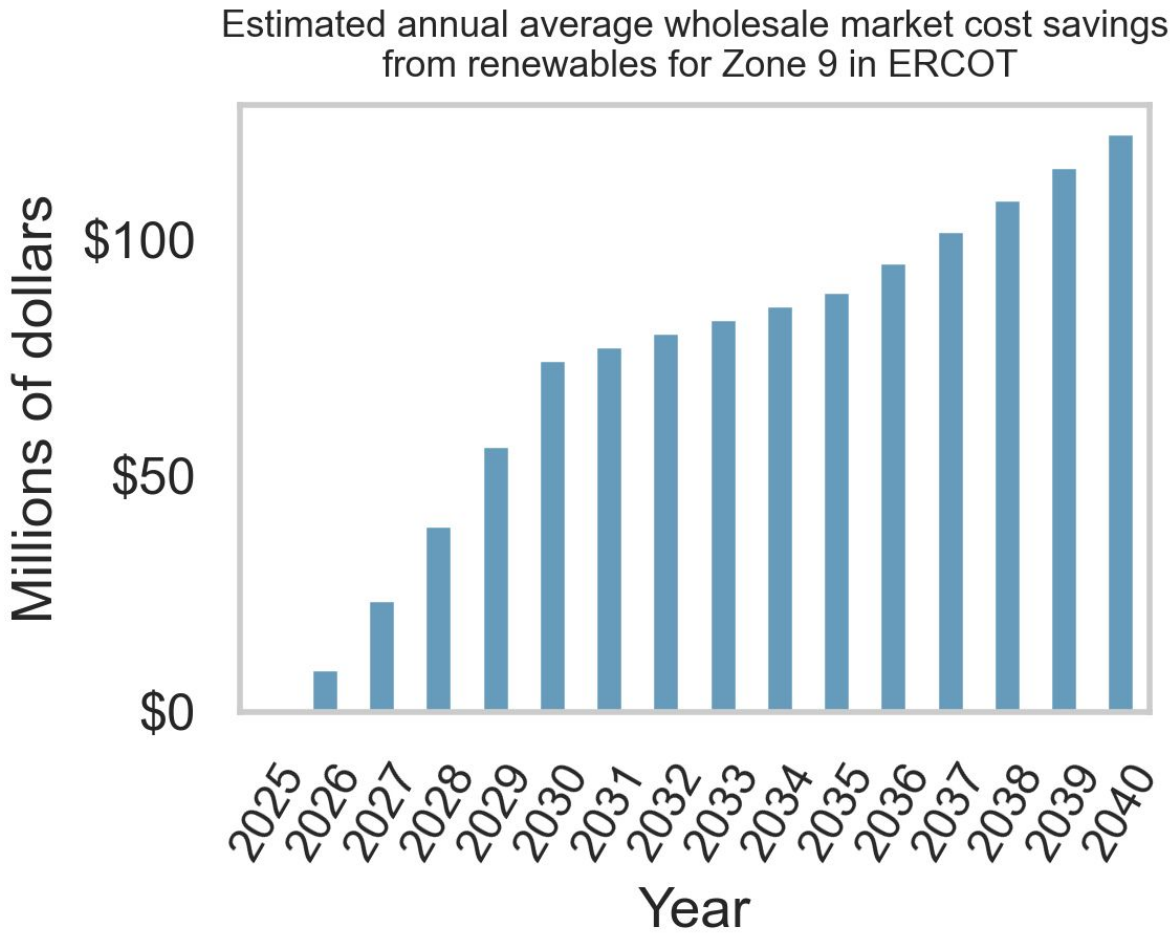
In Zone 9, we estimate that, with renewables, future average wholesale electricity costs will be about $11.39/MWh lower



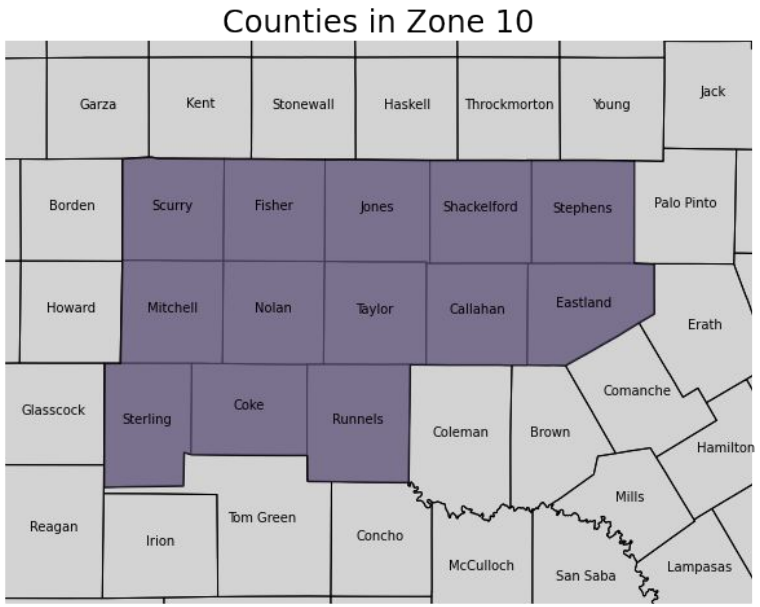


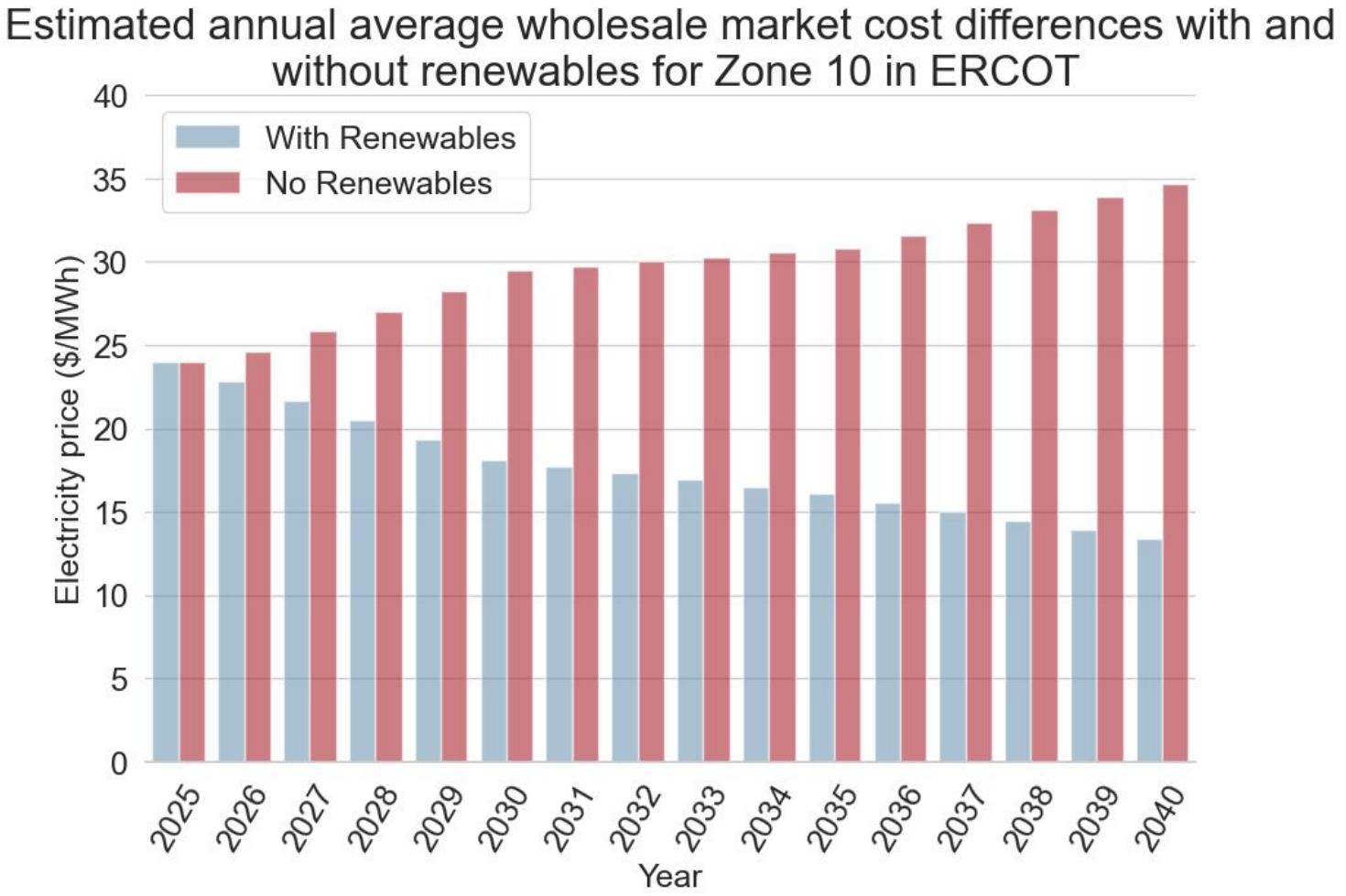
In Zone 9, we estimate that renewables will reduce total electricity wholesale market costs by about $1.2B between 2025-2040 and save commercial customers about 14% on electricity rates over the next 15 years

Average monthly electricity use (kWh)	Average annual savings over the next 15 years ($)
1,000	$ 136.64
5,000	$ 683.18
10,000	$ 1,366.35
100,000	$ 13,663.53



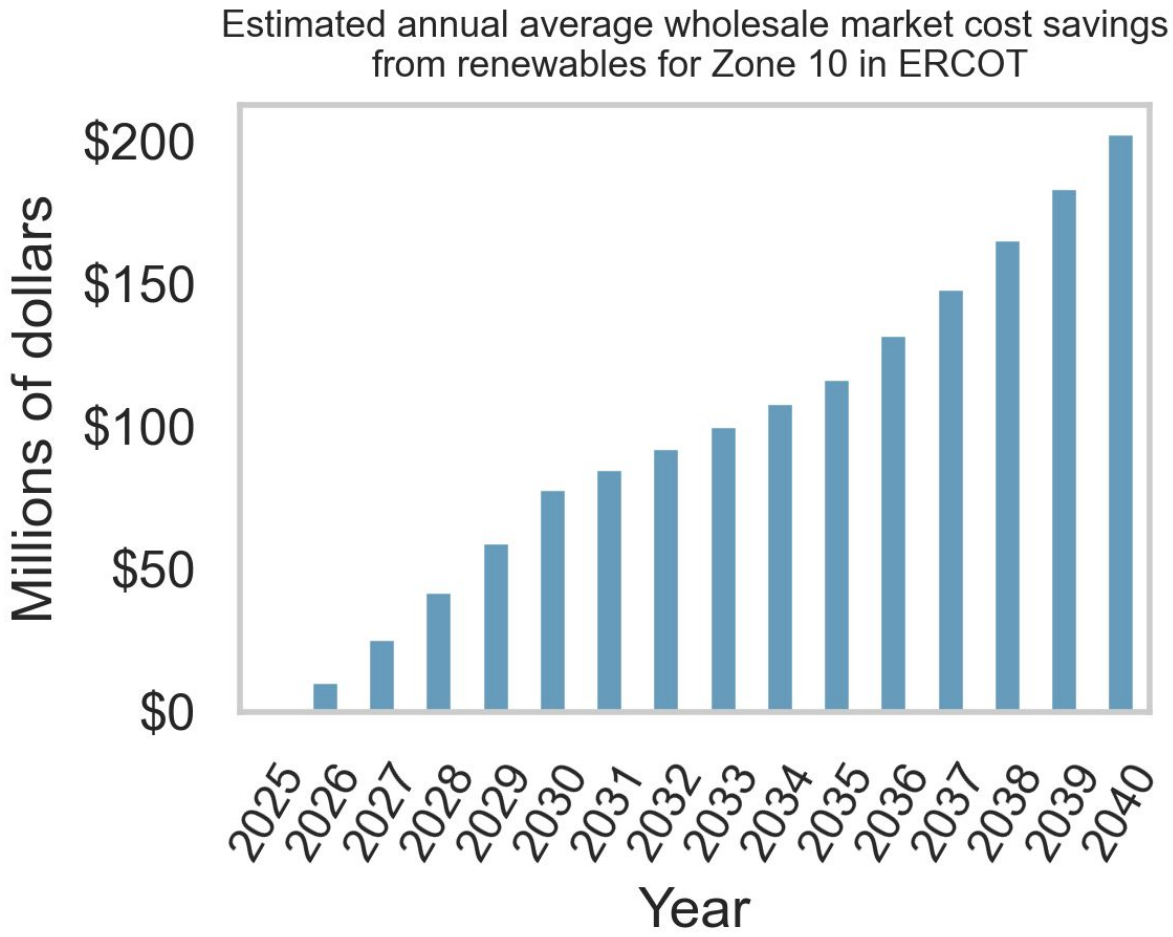
In Zone 10, we estimate that, with renewables, future average wholesale electricity costs will be about $12.87/MWh lower



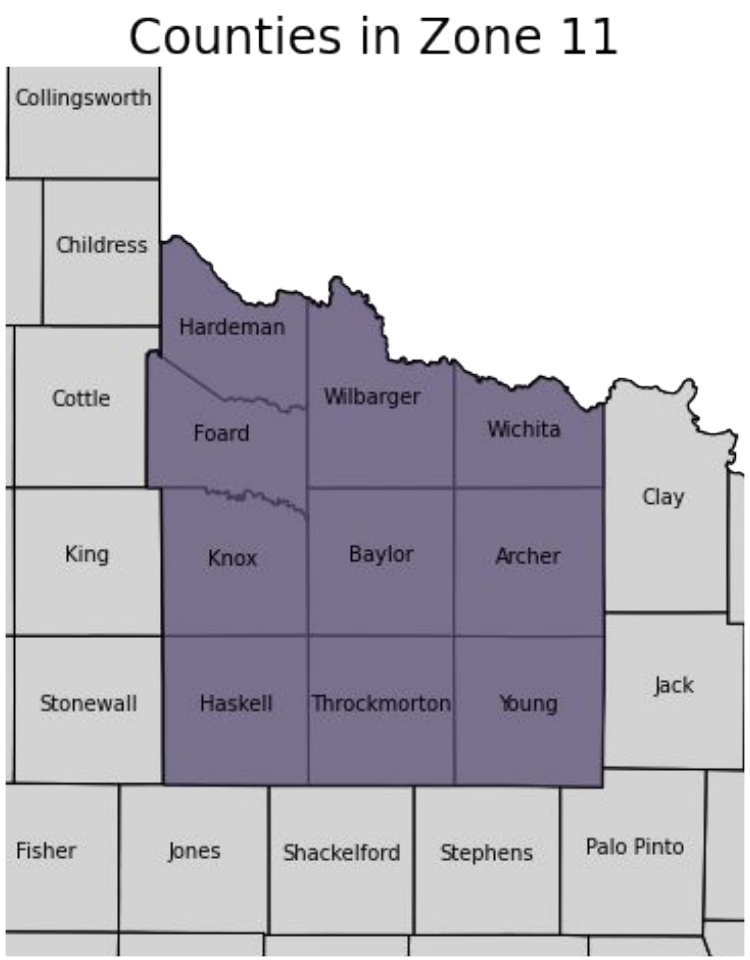


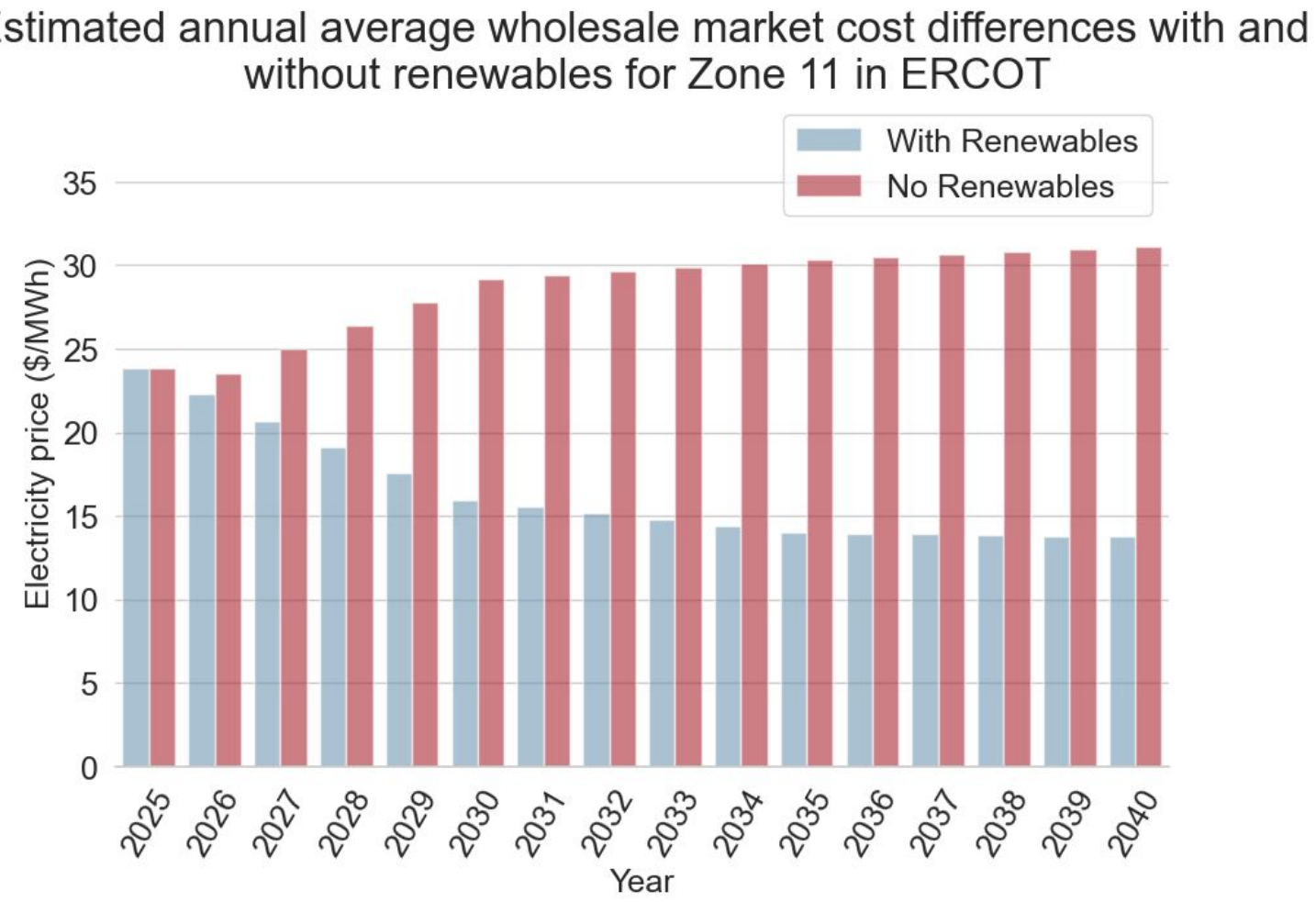
In Zone 10, we estimate that renewables will reduce total electricity wholesale market costs by about $1.6B between 2025-2040 and save commercial customers about 15% on electricity rates over the next 15 years

Average monthly electricity use (kWh)	Average annual savings over the next 15 years ($)
1,000	$ 154.44
5,000	$ 772.22
10,000	$ 1,544.45
100,000	$ 15,444.48



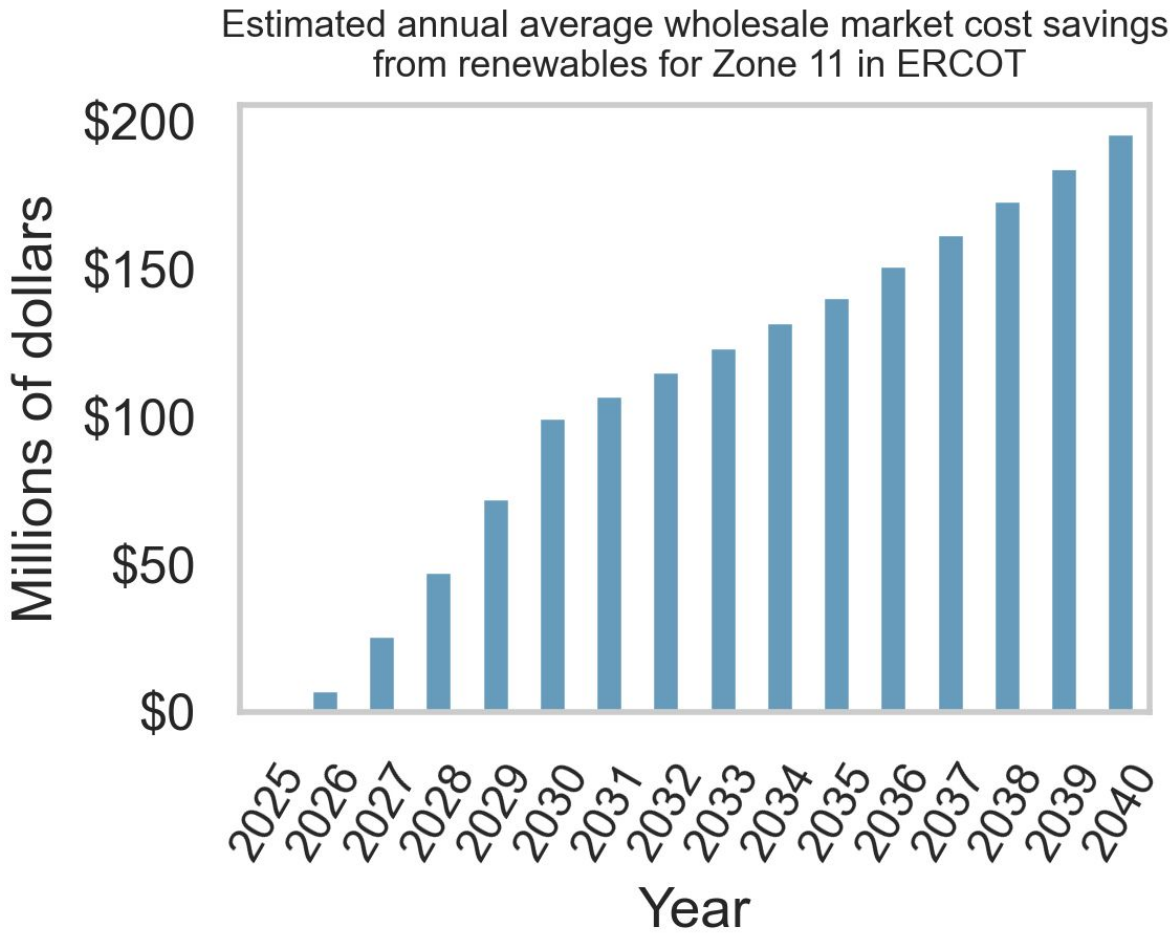
In Zone 11, we estimate that, with renewables, future average wholesale electricity costs will be about $13.12/MWh lower





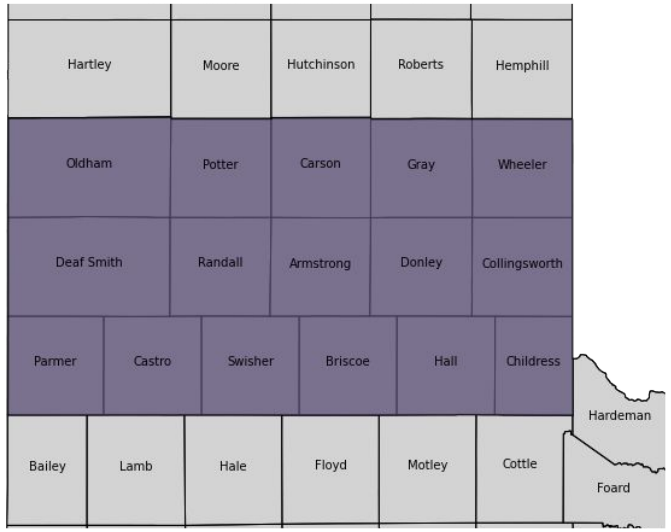
In Zone 11, we estimate that renewables will reduce total electricity wholesale market costs by about $1.7B between 2025-2040 and save commercial customers about 16% on electricity rates over the next 15 years

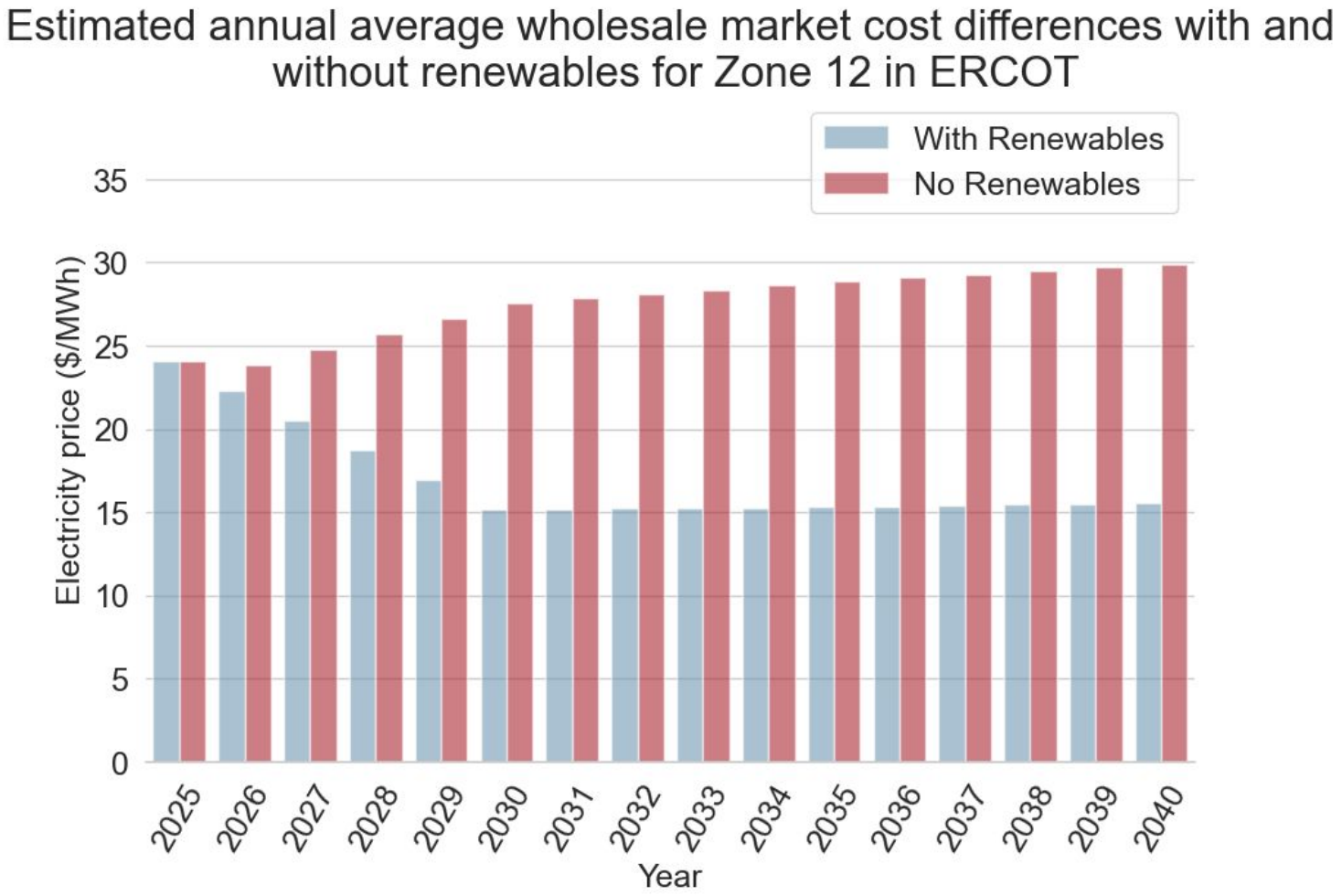
Average monthly electricity use (kWh)	Average annual savings over the next 15 years ($)
1,000	$ 157.46
5,000	$ 787.28
10,000	$ 1,574.56
100,000	$ 15,745.60



In Zone 12, we estimate that, with renewables, future average wholesale electricity costs will be about $11.38/MWh lower

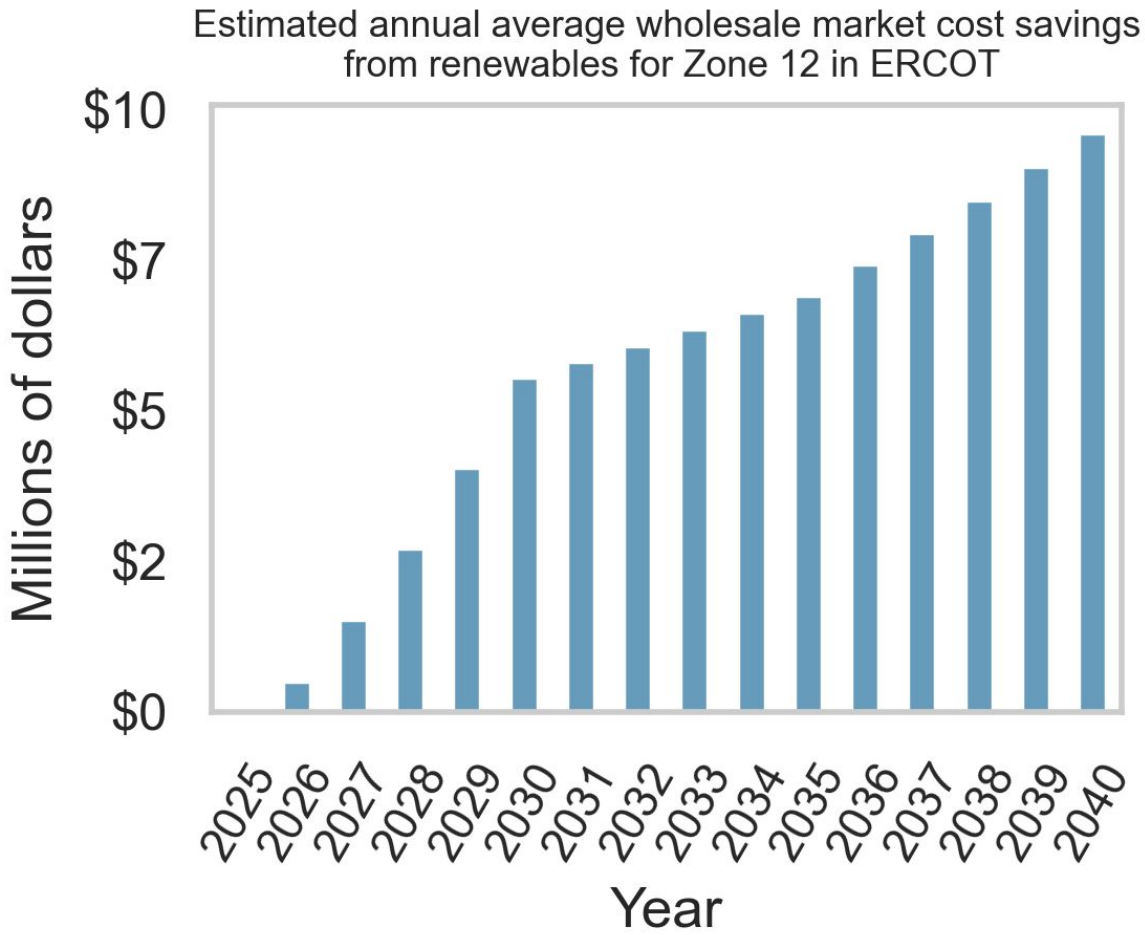
Counties in Zone 12



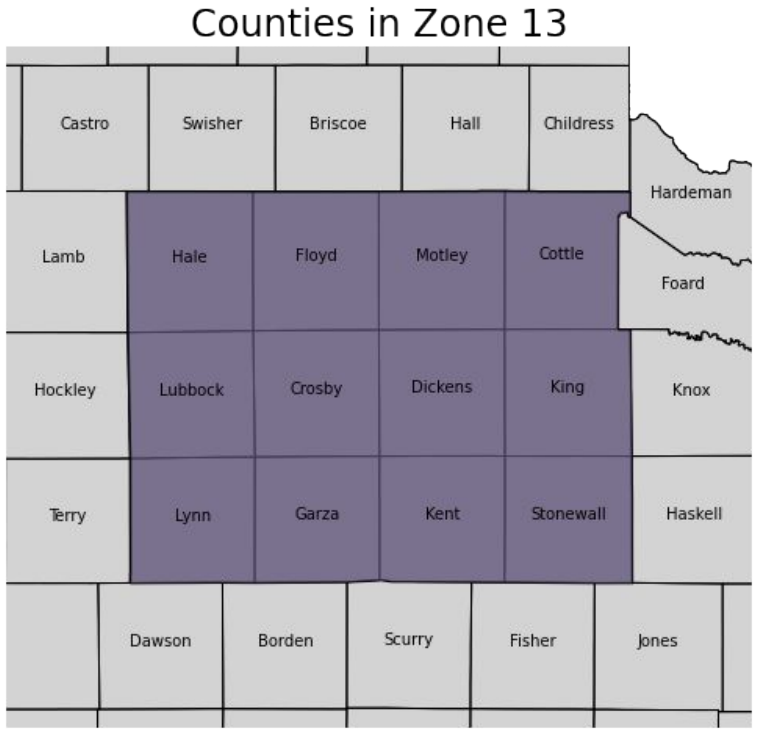


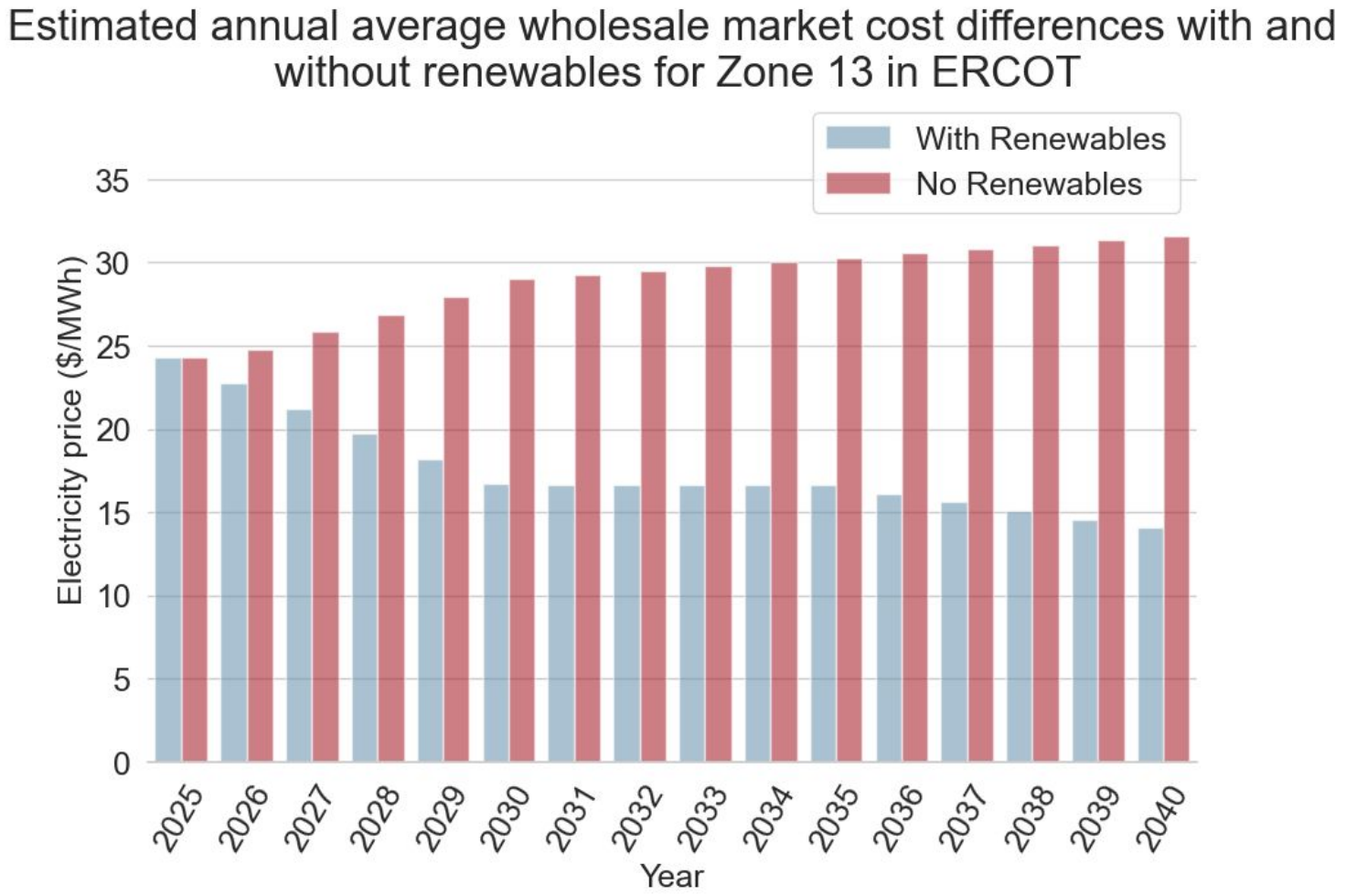
In Zone 12, we estimate that renewables will reduce total electricity wholesale market costs by about $100M between 2025-2040 and save commercial customers about 14% on electricity rates over the next 15 years

Average monthly electricity use (kWh)	Average annual savings over the next 15 years ($)
1,000	$ 136.56
5,000	$ 682.82
10,000	$ 1,365.65
100,000	$ 13,656.48



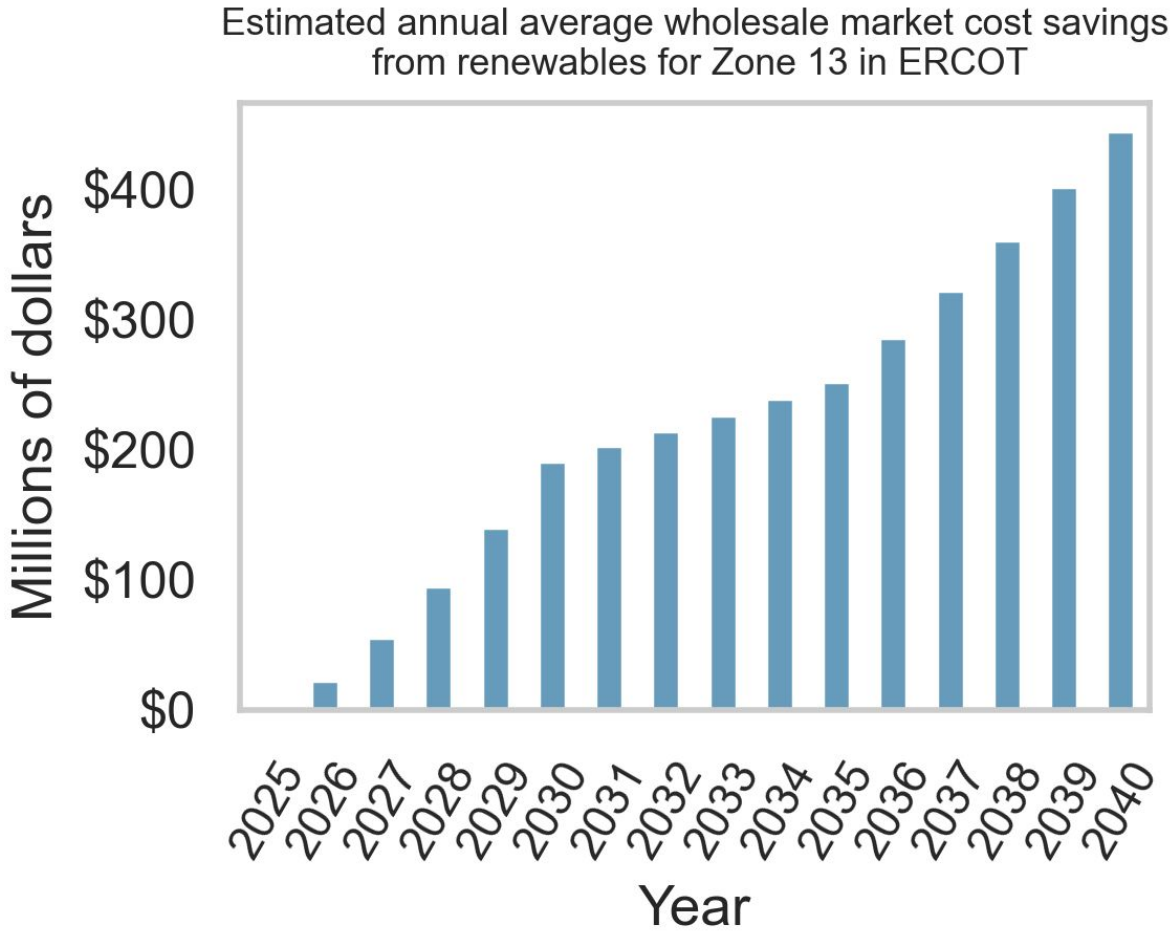
In Zone 13, we estimate that, with renewables, future average wholesale electricity costs will be about $12.10/MWh lower



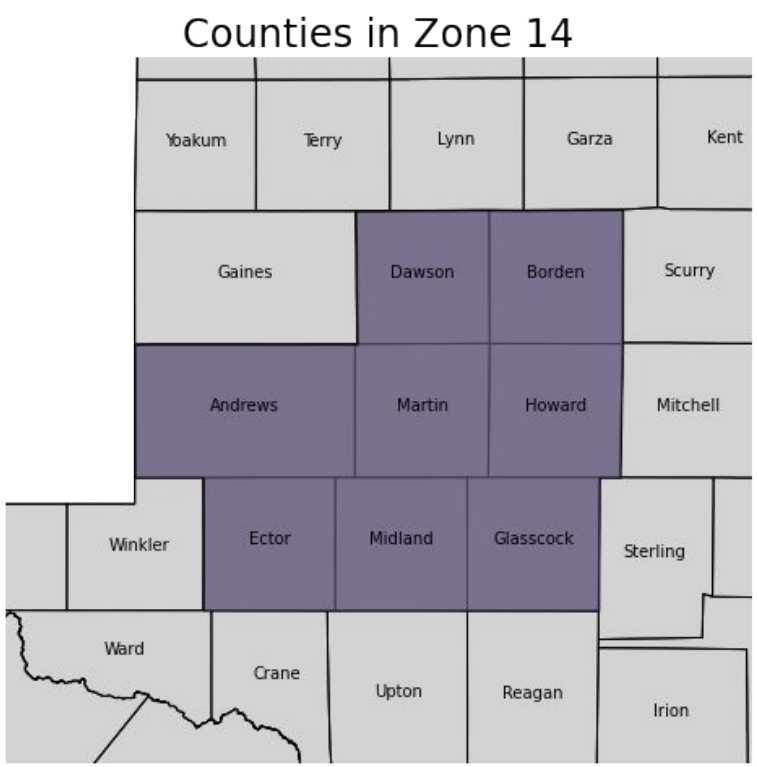


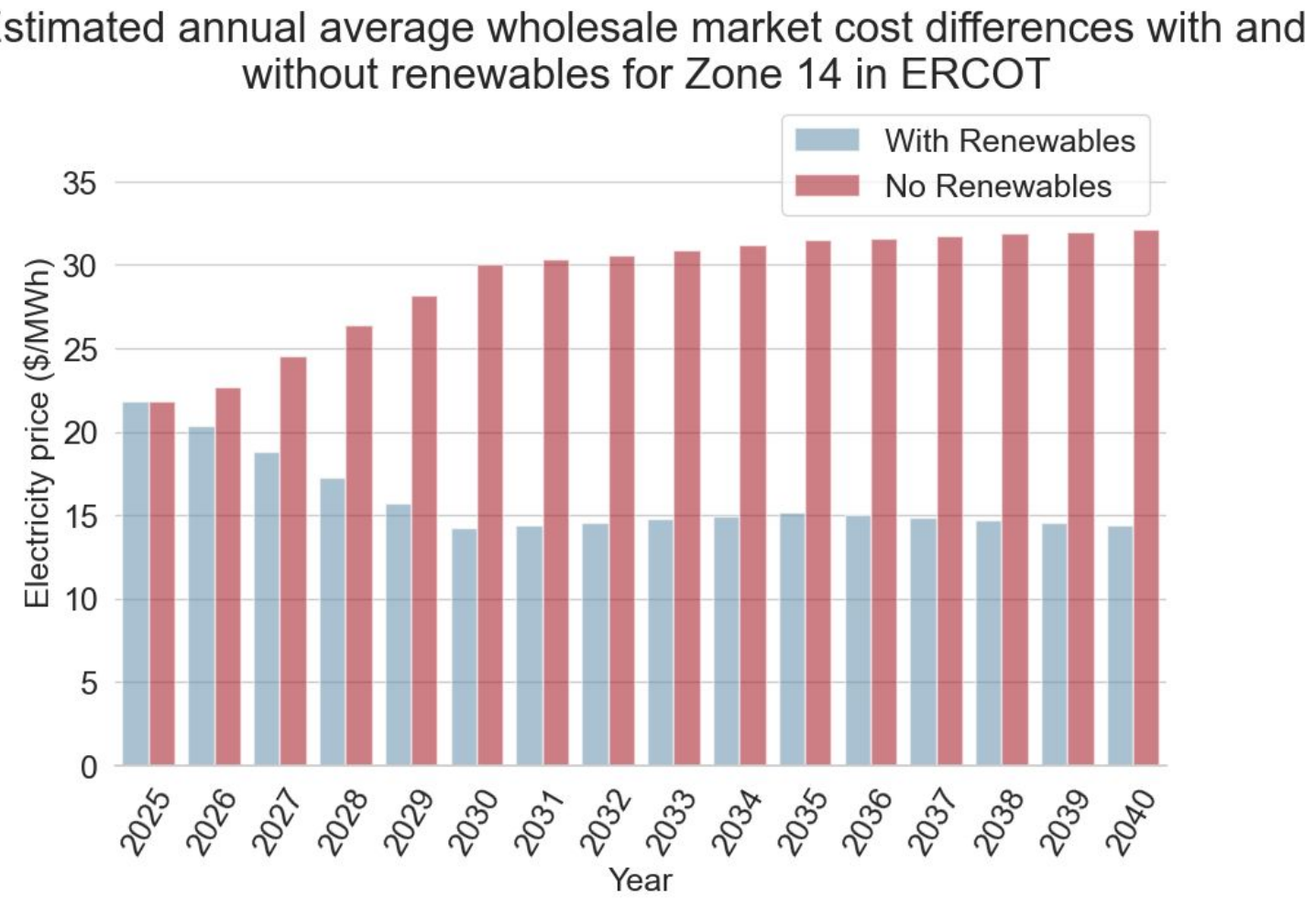
In Zone 13, we estimate that renewables will reduce total electricity wholesale market costs by about $3.5B between 2025-2040 and save commercial customers about 14% on electricity rates over the next 15 years

Average monthly electricity use (kWh)	Average annual savings over the next 15 years ($)
1,000	$ 145.20
5,000	$ 725.99
10,000	$ 1,451.97
100,000	$ 14,519.70



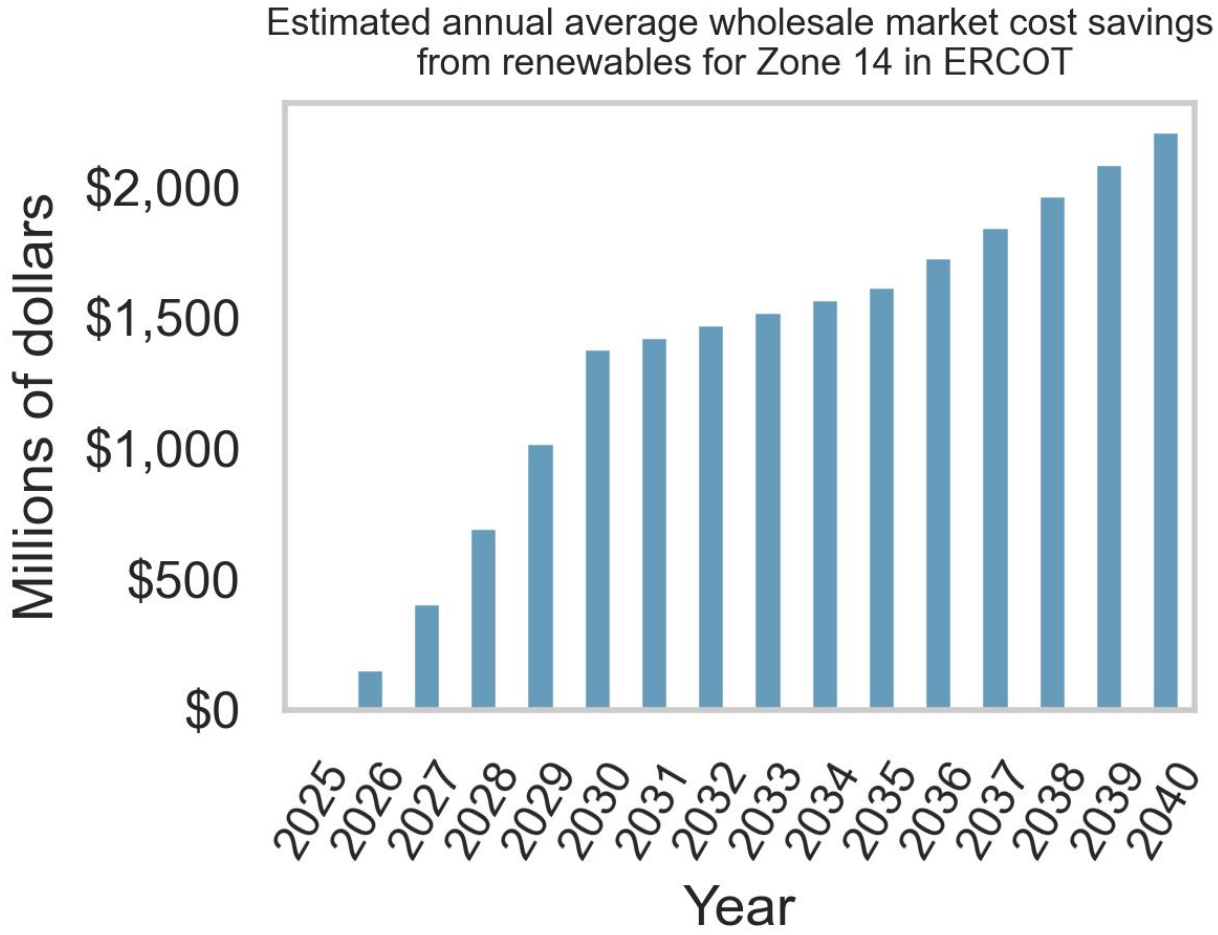
In Zone 14, we estimate that, with renewables, future average wholesale electricity costs will be about $14.14/MWh lower



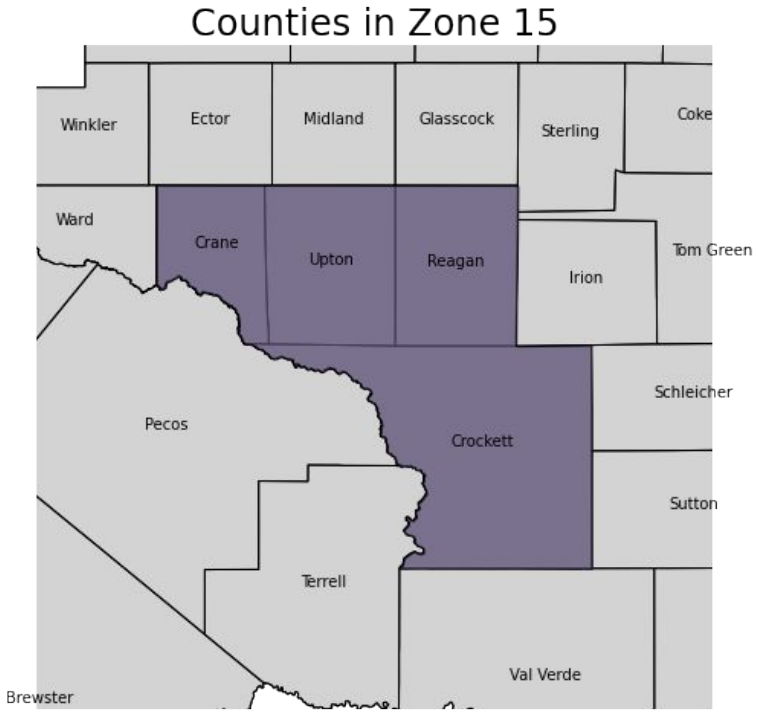


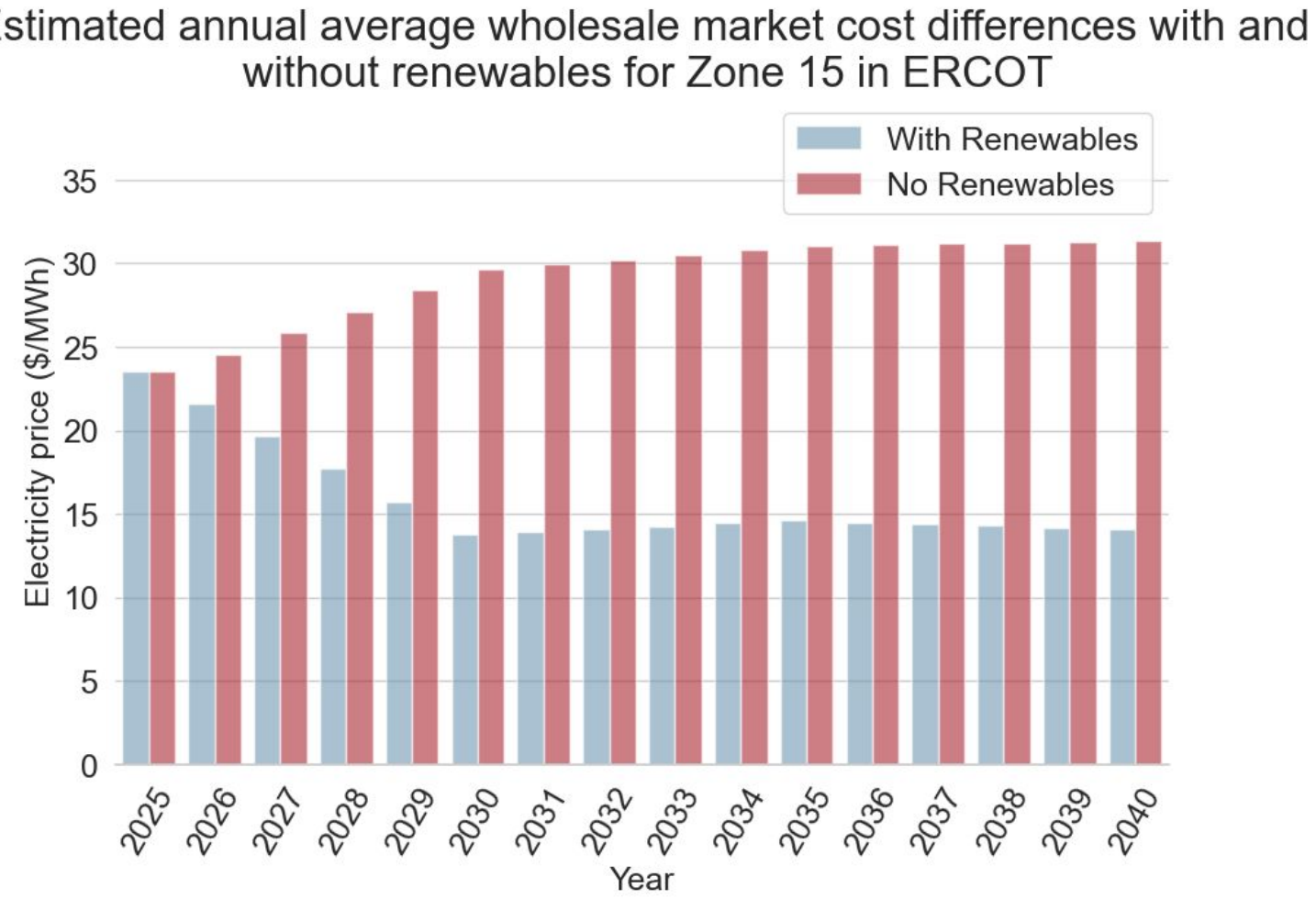
In Zone 14, we estimate that renewables will reduce total electricity wholesale market costs by about $21B between 2025-2040 and save commercial customers about 17% on electricity rates over the next 15 years

Average monthly electricity use (kWh)	Average annual savings over the next 15 years ($)
1,000	$ 169.66
5,000	$ 848.30
10,000	$ 1,696.61
100,000	$ 16,966.08



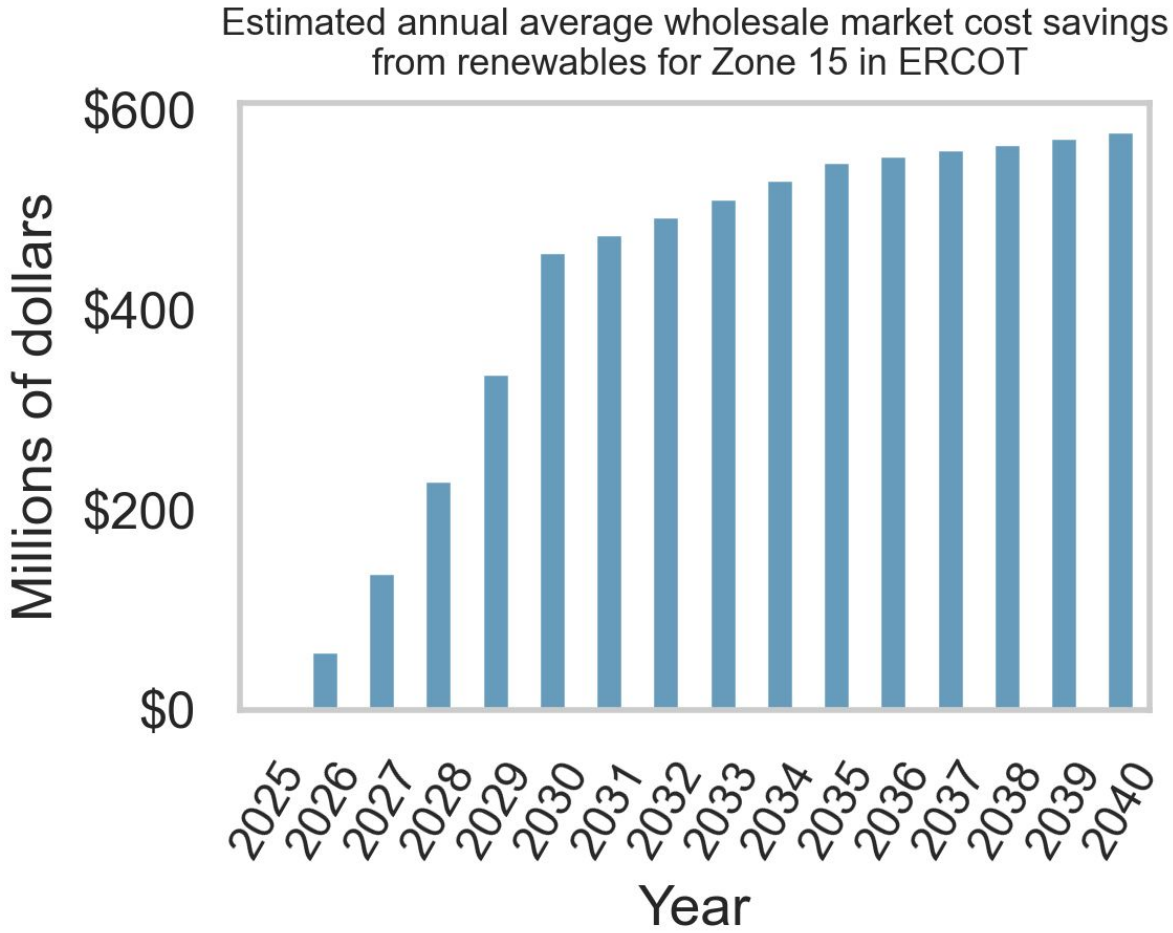
In Zone 15, we estimate that, with renewables, future average wholesale electricity costs will be about $14.20/MWh lower



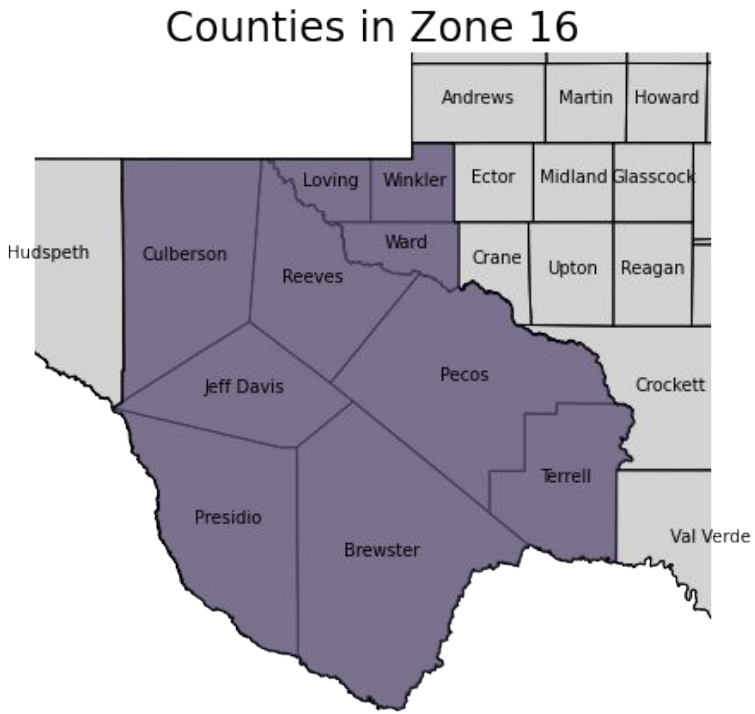


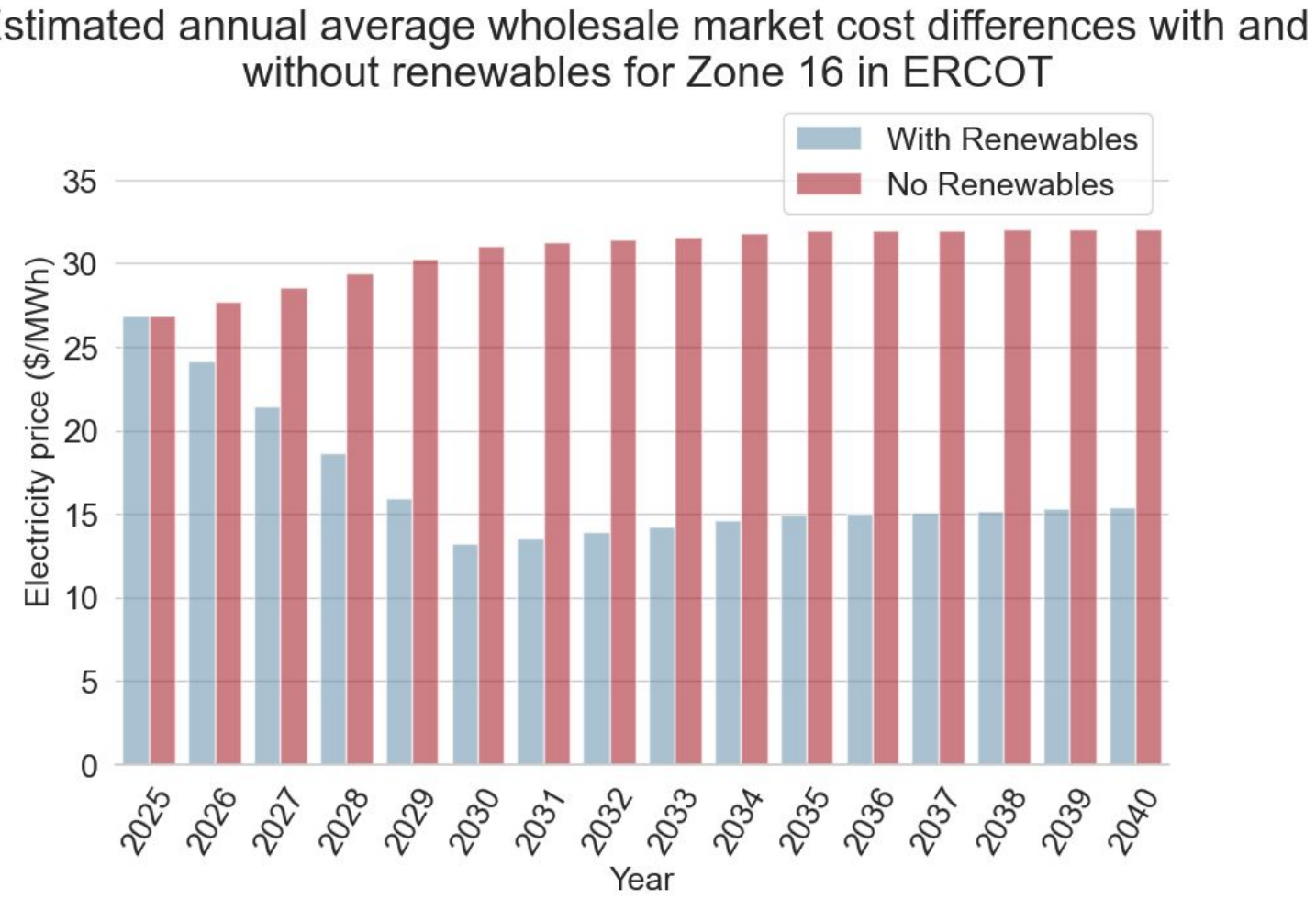
In Zone 15, we estimate that renewables will reduce total electricity wholesale market costs by about $6.6B between 2025-2040 and save commercial customers about 17% on electricity rates over the next 15 years

Average monthly electricity use (kWh)	Average annual savings over the next 15 years ($)
1,000	$ 170.41
5,000	$ 852.03
10,000	$ 1,704.07
100,000	$ 17,040.70



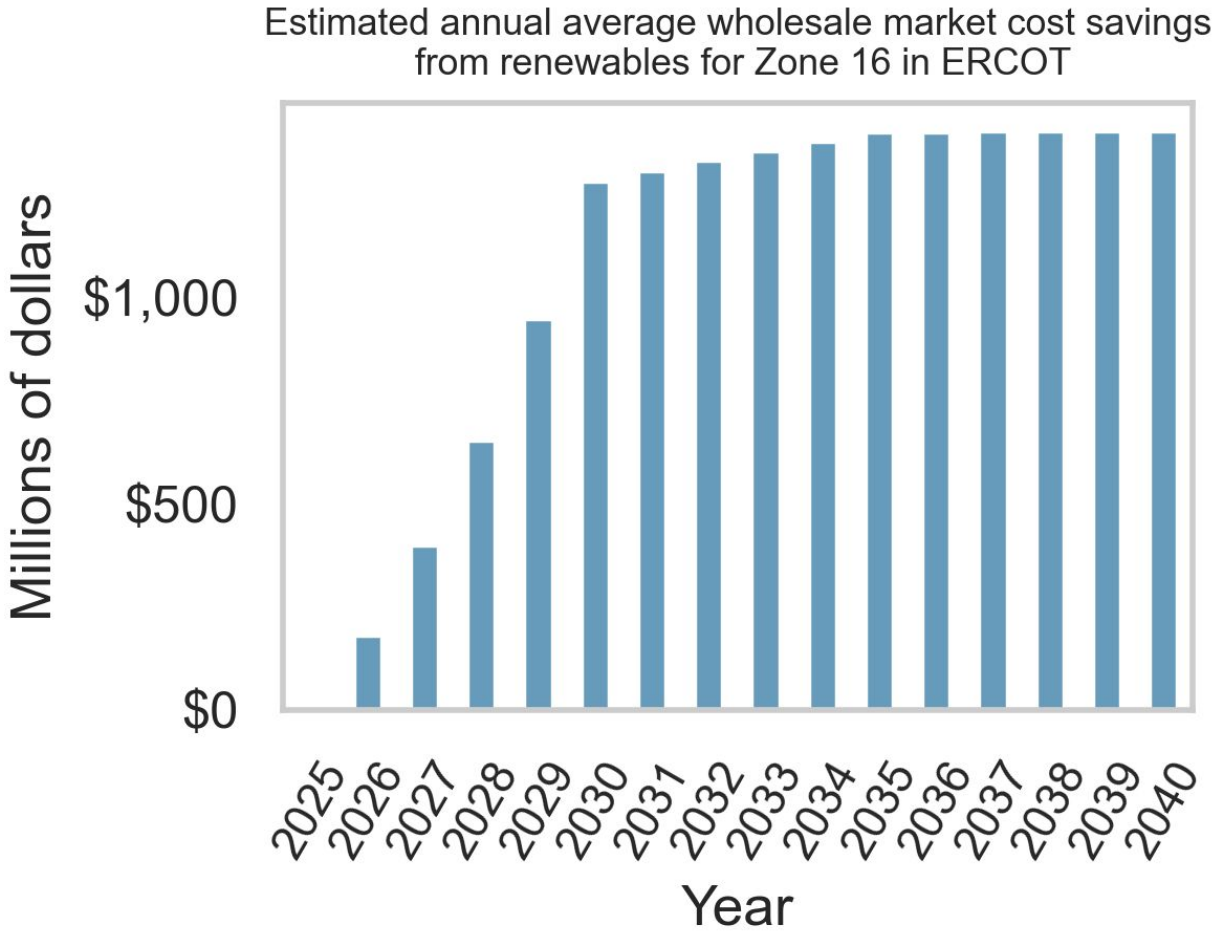
In Zone 16, we estimate that, with renewables, future average wholesale electricity costs will be about $14.97/MWh lower





In Zone 16, we estimate that renewables will reduce total electricity wholesale market costs by about $17B between 2025-2040 and save commercial customers about 18% on electricity rates over the next 15 years

Average monthly electricity use (kWh)	Average annual savings over the next 15 years ($)
1,000	$ 179.64
5,000	$ 898.21
10,000	$ 1,796.42
100,000	$ 17,964.20



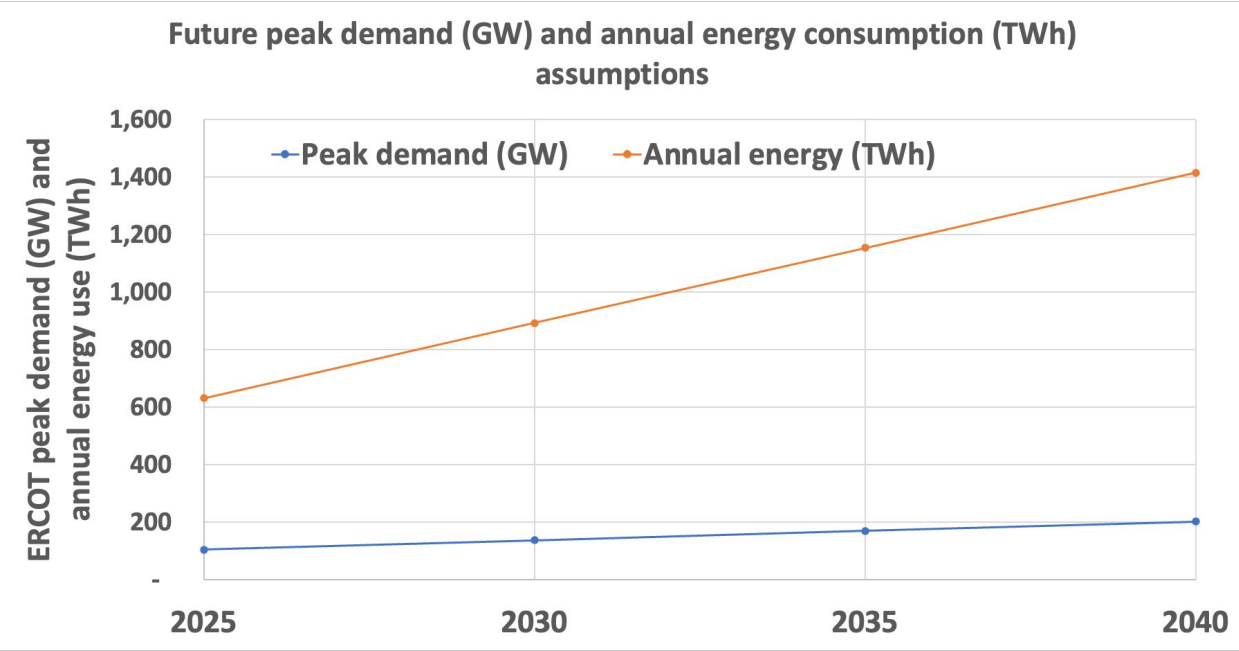
Abbreviated methods

- This analysis utilized a unit commitment and capacity expansion model (GenX) to estimate how much higher wholesale electricity would cost if no renewables were allowed to be built past 2025.[1]
- The model assumed that the ERCOT grid would see significant load growth based on current projections by the ISO.[2]
- The model was directed to build all power plants in the Texas Energy Fund as well as transmission lines associated with the Permian Reliability Plan.
- Regional cost savings were calculated based on the dispatch of power plants and the movement of power along the transmission network to meet demand in each region of the grid.[3]
- The impacts on bills was based on the energy component of commercial rates in Texas.[4]
- Full methodology is outlined in a separate companion document.

1. https://static1.squarespace.com/static/652f1dc02732e6621adb2a3a/t/65668d03bd8efd2fbfb45b15/1701219588273/GridLab_Impact+of+Renewables+Summer+2023.pdf
2. https://www.ercot.com/files/docs/2024/06/07/2024%20Long-Term%20System%20Assessment%20(LTSA)%20High%20Load%20Growth%20Scenario_June11_2024.pdf
3. https://www.texasadvancedenergy.org/hubfs/2023%20Reports/ERCOT%202040%20Roadmap%20Transmission%20Study_Ideasmiths_2023.pdf
4. https://static1.squarespace.com/static/652f1dc02732e6621adb2a3a/t/654c1889d23c9b5e380aa6bf/1699485834626/Impact-of-Renewables-in-ERCOT_FINAL.pdf

Abbreviated load assumptions used in this report

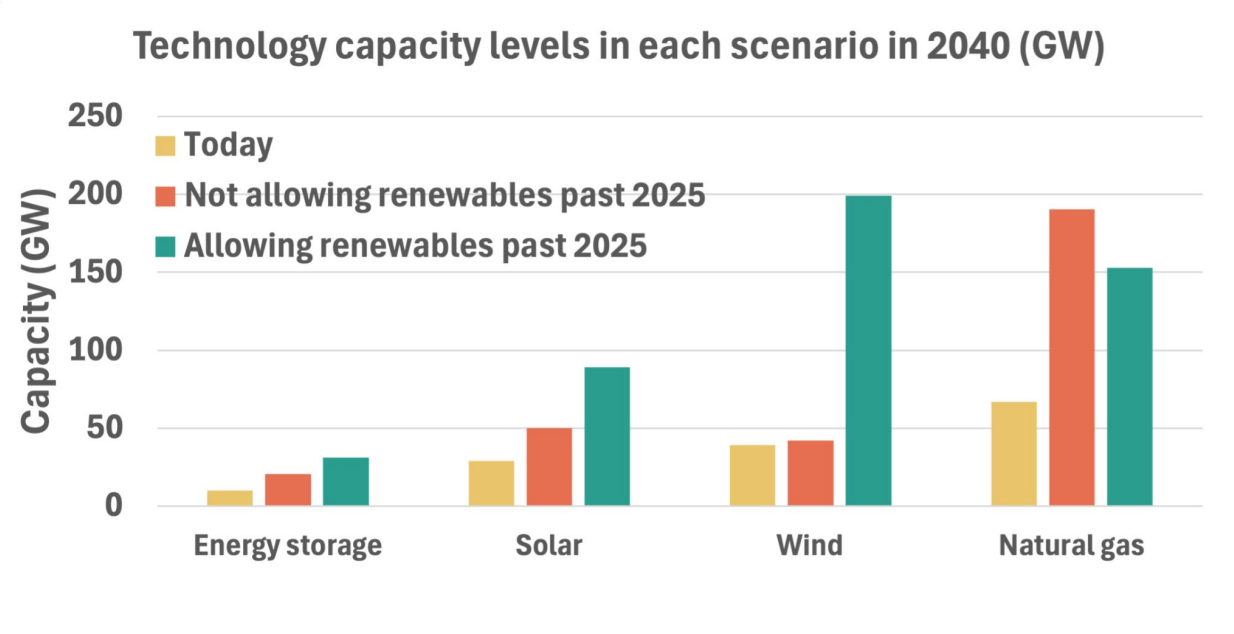
- In this report, we assumed that loads would grow significantly in ERCOT
- Near term load growth projections (to 2030) were based on ERCOT's recent presentations[1]
- Longer-term load growth projections (to 2040) were based on ERCOT Long-Term System Assessment projections for continued high load growth[2]
- Using these assumptions yielded 2040 estimates:
  - Energy: ~1,400 TWh
  - Peak Demand: ~200 GW



1. https://www.ercot.com/files/docs/2024/04/22/5%20CEO%20Update.pdf
2. https://www.ercot.com/files/docs/2024/06/07/2024%20Long-Term%20System%20Assessment%20(LTSA)%20High%20Load%20Growth%20Scenario_June11_2024.pdf

Abbreviated future model results

- In the restricted model, the model could not build any renewable energy or storage past 2025
- In the unrestricted model, the model was able to build any technology. When allowed to build the most cost optimal future, the model deployed more renewable energy capacity:
  - Wind: 157 GW more
  - Solar: 39 GW more
  - Energy storage: 10 GW more
  - Natural gas: 38 GW less
- Nuclear and coal were not impacted by the scenario differences
  - No nuclear was built in either scenario
  - No coal retired in either scenario because of higher load growth



Abbreviated model results discussion

- Across all regions, we estimate that renewables would reduce energy costs between 4%-18% (average 12%) for commercial customers.
- The ranges vary because of two main drivers:
  - The locations of the best wind and solar in the state
  - The locations of new large loads across the state
- West and Central Texas:
  - Best wind and solar resources in the state
  - High load growth due to electrification of oil and gas operations
- North Texas:
  - High load growth due to datacenter activity

Abbreviated model results discussion (continued)

- This difference in where renewables were built influenced local prices
- The model also built transmission where economically efficient to do so, but there is some level of congestion as it is not always efficient to completely get rid of it
- One impact of these new large loads in areas where renewables are generally better suited (West Texas) is that much of the power generated stays in those regions
  - This is also why we see more wind than solar – wind has a more “baseload”-like pattern than solar does
- Thus, while all of the state sees benefits from allowing renewables to be part of the grid of the future, some areas feel the impact more

Acknowledgements and About Us

- This work was funded by the Texas Energy Buyers Alliance (TEBA).[1] The Texas Energy Buyers Alliance (TEBA) is working with small and large employers across Texas to reduce energy costs, protect the state's competitive energy market, and ensure our infrastructure meets the state's future needs.

- IdeaSmiths LLC[2] was founded in 2013 to provide clients with access to professional analysis and development of energy systems and technologies. Our team focuses on energy system modeling and assessment of emerging innovations, and has provided support to investors, legal firms, and Fortune 500 companies trying to better understand opportunities in the energy marketplace.

1. https://txenergybuyers.com/
2. https://www.ideasmiths.com/

The impact of future deployments of renewable energy on local wholesale electricity prices and bills in ERCOT

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