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(REVIEW ARTICLE)

The energy landscape of Texas: From fossil fuel legacy to renewable powerhouse

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Abstract

Texas, historically known as the fossil fuel capital of the United States, has rapidly emerged as the nation's leader in renewable energy. As of 2024, the state has deployed 42 GW of wind, 32 GW of solar, and 4 GW of battery storage—surpassing California's renewable output by nearly double. This growth stems not from subsidies, but from a competitive, deregulated electricity market. This paper explores the evolution of Texas' energy mix, the policy and economic mechanisms behind its success, and the emerging policy headwinds that risk undermining this progress.

Keywords: Energy Landscape; Energy Mix; Texas; Energy Economics; Renewable

1. Introduction

Texas has long stood as an icon of fossil fuel dominance, producing more crude oil and natural gas than any other U.S. state (EIA, 2024). Yet over the past decade, Texas has undergone a remarkable transition—one that redefines its identity as a global energy hub. With renewable energy output nearing 170,000 GWh in 2024, Texas now leads the nation not only in total renewable generation but also in capacity growth, particularly in wind, solar, and battery storage (ERCOT, 2024).

This paper analyzes the market dynamics, policy frameworks, and economic drivers that have enabled this shift, highlighting the unique blend of free-market economics and technological advancements that differentiate Texas from subsidy-driven models seen in states like California.

2. Methodology

The paper synthesizes data from ERCOT generation reports (2020–2024), U.S. Energy Information Administration (EIA) capacity statistics, and public statements from energy executives such as ERCOT CEO Pablo Vegas. A comparative analysis is used to evaluate Texas' market-based approach versus policy-driven models like California's. Additionally, the study incorporates insights from grid performance, investment trends, and renewable integration metrics to assess the impact on reliability and economic growth.

3. Discussion

3.1. The Competitive Edge: Free Market Power

At the heart of Texas' renewable boom lies its deregulated electricity market. Unlike California, which offers extensive renewable subsidies, Texas has enabled cost-based competition among power producers. As renewable costs have plummeted battery storage costs alone have fallen 50% since 2017 (Bloomberg NEF, 2024) these technologies have

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naturally outcompeted traditional fossil fuels in many cases, making deployment financially viable without government aid.

3.2. Record-Breaking Growth

From 2019 to 2024

- Solar capacity expanded from ~4 GW to 32 GW (800% growth).
- Wind capacity rose by 50% to reach 42 GW.
- Battery storage surged by 5,500%, hitting 4 GW in 2024 alone (ERCOT, 2024).

This rapid deployment has doubled the state's renewable output to nearly 170,000 GWh, well ahead of California's ~88,000 GWh (SEIA, 2024).

3.3. Economic Impact and Investment

This abundance of low-cost, reliable electricity has become a magnet for capital-intensive industries. AI data centers, chip fabrication plants, and cryptocurrency mining facilities have clustered in Texas, drawn by electricity prices that undercut national averages (Reuters, 2024). The result is a virtuous cycle: renewables drive cheap power, which drives industrial growth, which demands more capacity—and investment continues to flow.

3.4. Policy Reversal Risks

Despite its success, the Texas model is now under threat. Recent policy shifts by state legislators and the Public Utility Commission (PUC) are tilting the playing field back toward natural gas. These include proposed rollbacks of property tax exemptions for solar and wind, capacity market discussions that favor dispatchable thermal assets, and permitting hurdles for new battery projects (Texas Tribune, 2024).

As ERCOT CEO Pablo Vegas recently warned "Without that growth of renewables, the Texas grid is dead in the water, and so is the economy" (Lewin, 2024).

These interventions risk eroding investor confidence and slowing grid modernization at a time when electrification demands are surging.

4. Conclusion

Texas has shown that it's possible to achieve national leadership in renewable energy not through mandates, but through smart market design. The state's experience offers a compelling model for scaling clean energy in economically viable ways. However, sustaining this progress requires resisting policy backsliding and preserving the competitive neutrality that allowed renewables to thrive. The energy landscape of Texas is proof that economic growth and decarbonization are not mutually exclusive if markets are allowed to work.

Compliance with ethical standards

Disclosure of conflict of interest

No Conflict of Interest to be disclosed. It has been presented at 2025 Exploration and Production Standards API meeting on Oilfield Equipment and Materials - Scottsdale, Arizona

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