Economic impacts of renewables in Texas

Assessment of 1st order economic impacts
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Texas is a leader in renewable power (wind, solar, batteries) today
• 45 GW of installed capacity; supplying ~25% of annual Texas energy consumption
• 1st among US states in wind, solar capacity; top 5 when compared to all countries

Renewables have delivered investments, jobs, and economic activity
• $400-500M/yr of reinvestment (tax, etc.) in local communities, ~80% rural
• 80-90k direct + indirect jobs created; 30%+ higher paying jobs vs Texas average
• >$70B in capital investments in Texas renewables from 2000 to 2021

Renewables could significantly grow beneficial impacts by 2030
• Current trajectory to 2.5x increase in Texas renewables capacity by 2030 (vs 2021)
• Planned new capacity (largely solar, batteries) expands into new communities
• Potential for creation of up to +50k new direct + indirect jobs
• Pathway to +$70-90B in capital investments by 2030 while also roughly tripling annual tax revenue generation and landowner payments

Renewables can be a foundation for new, clean energy tech in Texas
• Capturing 10% of 2050 global Green H2, Direct Air Capture, Sustainable Aviation Fuel demand would require a 10x renewables capacity increase in Texas
• Cost competitive renewables + skilled workforce are foundational to buildout
Texas is a leader in renewables

Total 2021 capacity of wind, solar, batteries (GW, 2021)

Favorable market drivers

• Advantaged resource quality for wind and solar
• Open competitive market and deregulation
• Supportive permitting for new renewables development
• Competitive renewable energy zone (CREZ) policies for transmission

Texas also ranks among the top 5 countries in wind & solar capacity¹ ... … yet wind and solar make up only ~25% of its total energy generation

1. IRENA RE Capacity Statistics 2022 - leading countries (excluding the US) in 2021 solar & wind capacity (GW) include China, Germany, India, Japan, and Spain; 2. Approved by Legislature in 2005, mandates utility buildout of transmission lines to support transport of renewable energy from West Texas to demand centers in Central Texas

Source: EIA; IRENA; NREL(https://www.nrel.gov/disclaimer.html); PUCT; TX Comptroller
Analysis focuses on 1\textsuperscript{st} order economic impacts

1\textsuperscript{st} order economic impacts

1. Impact distribution
   Geographic spread of renewables state-wide

2. Jobs creation
   Direct, indirect, construction vs. ongoing

3. Top-line financial impacts
   GDP, investment/capex spend, tax revenue, landowner payments

2\textsuperscript{nd} order economic impacts

Not covered here, e.g., wholesale market price dynamics, legacy power generation jobs, grid reliability and resilience, economic development associated with availability of green electricity

Effects may be positive or negative depending on regulation and policy

Parameters assessed according to:

A. What is in the ground today
B. Possible future growth
Growth of renewables in Texas

Total capacity of wind, solar & batteries (GW, 2000-2021)

$70-90B in total investments (CapEx) (USD from 2000-2021)

1999 Senate Bill 7 begins energy market deregulation in TX

2005 Established goal of 5.9GW by 2015 and 10GW by 2025

2013 All CREZ projects energized

2020

45GW

~3x

1. Texas Senate Bill 7 unbundled each of the three stages of electricity provisioning: generation providers, transmission owners & retail companies
2. Goal established as facet of REC program
3. Competitive Renewable Energy Zone (CREZ) established 3600 miles of transmission lines allowing for the transportation of 18.5GW of capacity

Source: EIA; LBNL; Texas Legislature Online; Texas Comptroller; DOE
Current renewables footprint is heaviest in less dense, rural areas

2021 renewables capacity, by county

2021 population density, by county

Source: EIA; US Census Bureau
Renewables have created higher paying jobs in Texas

<table>
<thead>
<tr>
<th>Total Direct and Indirect Jobs Created</th>
<th>Permanent Jobs Created to Support Ongoing Operations</th>
<th>Higher Pay for Direct Jobs Created</th>
</tr>
</thead>
<tbody>
<tr>
<td>80-90k</td>
<td>15-20k</td>
<td>+30%</td>
</tr>
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</table>

1. Jobs associated with wind, solar, batteries; direct = tied to on-site operations; indirect = associated with the supply chain
2. Includes direct and indirect jobs associated with sustained operations; remaining jobs associated with construction of new renewables capacity which are maintained unless rate of capacity additions drops
3. On average for direct jobs created vs Texas state average

Note: Jobs figures given for 2021

Source: DOE USEER; EIA; LBNL; NREL (https://www.nrel.gov/disclaimer.html)
Today: Financial impacts

Annual financial benefits of renewables in Texas

<table>
<thead>
<tr>
<th>Non-comprehensive; select contributing factors to GDP</th>
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<table>
<thead>
<tr>
<th>Economic Impact</th>
<th>2021 Value Range (USD in 2021)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Texas RE Gross Domestic Product</td>
<td>$12-16B</td>
</tr>
<tr>
<td>Investments CapEx</td>
<td>$11-13B</td>
</tr>
<tr>
<td>Property Tax Revenue</td>
<td>$180-230M</td>
</tr>
<tr>
<td>Landowner Payments</td>
<td>$200-250M</td>
</tr>
</tbody>
</table>

~80% of financial benefits felt directly in rural Texas communities

1. Gross Domestic Product (GDP) measures the value of all final goods and services produced within the state; assumes Texas utilities GDP distributed in-line with capacity of various tech types; all values nominal
2. Includes grid interconnection costs, generation equipment, installation & owner’s costs associated with wind, solar, batteries
3. Drawn from Ch. 312/313 abatement filings; Ch. 312 extended through 2029; Ch. 313 to expire at end of 2022 but renewed three occasions previously and developers submitting applications for future projects prior to expiration
4. Based on BLM rates for rental of public land and expert verification
5. Assuming Census definition of rurality, less than 50K people for a given county & population density less than 500 persons per sq mile

Note: All values referenced are 2021
Source: EIA; LBNL; BEA; TexasLMI; NREL ATB (https://www.nrel.gov/disclaimer.html); Texas Comptroller; BLM; US Census Bureau; Expert Interviews
Future growth of renewables in Texas through 2030

Total capacity of wind, solar & batteries (GW, 2000-2030)

- **115GW** Current trajectory¹
- **65GW** Slow growth²
- **45GW** 2021 total capacity

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1. Post-Inflation Reduction Act (IRA, 16 Aug 2022) Rystad forecast for US wind & solar growth; assumed TX growth in capacity follows the forecasted US trend
2. Solar, wind, battery capacity planned according to May 2022 CDR report 3. High RE cost NREL forecast follows conservative NREL ATB estimations - slow decline in RE costs driven by policy & modest development

Note: Higher renewables growth in TX can support new in-state manufacturing for domestic equipment given policy incentives

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ERCOT planned capacity through 2025²

1.4x growth

2.5x growth

Source: EIA; LBNL; NREL Cambium (https://www.nrel.gov/disclaimer.html); ERCOT; Rystad
Distribution of in-development renewables capacity in Texas and jobs impacts

Projected renewables capacity additions\(^1\), by county

*Expected shift toward more solar and batteries*

\(~2.5\) GW of renewables capacity to be added in non-ERCOT territories by 2030\(^3\)

Anticipated jobs impacts of renewables growth rates

<table>
<thead>
<tr>
<th>Number of direct, indirect jobs(^2)</th>
<th>Jobs</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Ongoing operations</td>
</tr>
<tr>
<td>80-90K</td>
<td>+ + + +</td>
</tr>
<tr>
<td>130-140K</td>
<td>Current trajectory</td>
</tr>
<tr>
<td>30-40K</td>
<td>Slow growth</td>
</tr>
<tr>
<td>2021</td>
<td></td>
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<tr>
<td>2030</td>
<td></td>
</tr>
</tbody>
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1. Includes solar photovoltaic, onshore wind turbine, and batteries Generator Interconnection active project requests; 2. Jobs associated with wind, solar, batteries; direct = tied to on-site operations; indirect = associated with supply chain; 3. Renewable capacity addition estimated by assuming proportional distribution of total 2030 renewables commitment based on existing percentage of capacity within Texas; 4. Estimates based on utility forecasts/projections

Note: Job creation analysis leverages multiplying factor approach to derive implied future jobs based on per year capacity additions and aggregate capacity

Source: ERCOT, DOE USEER; EIA; LBNL; NREL (https://www.nrel.gov/disclaimer.html); El Paso Electric; ENTERGY; SWEPCO; Xcel Energy
Potential 2030 financial impacts of renewables in Texas

<table>
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<tr>
<th>Current trajectory</th>
<th>Slow growth</th>
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<tbody>
<tr>
<td><strong>Cumulative Investment</strong>&lt;sup&gt;1&lt;/sup&gt;</td>
<td><strong>$70-90B</strong></td>
</tr>
<tr>
<td>Total USD from 2022 to 2030</td>
<td>Matching total investment from previous two decades</td>
</tr>
</tbody>
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| **Annual Property Tax Revenue**<sup>2</sup> | **$500-600M** | **$250-350M** |
| Total USD in 2030 | ~3x increase from 2021 to 2030 | |

| **Annual Landowner Payments**<sup>3</sup> | **$450-550M** | **$200-300M** |
| Total USD in 2030 | ~2x increase from 2021 to 2030 | |

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1. Includes interconnection costs, equipment, installation & owner’s costs
2. Drawn from Ch. 312/313 abatement filings; Ch. 312 extended through 2029; Ch. 313 to expire at end of 2022 but renewed three occasions previously & developers submitting applications for future projects prior to expiration
3. Leveraged rental rate for public land

Notes: GDP expected to increase modestly for current trajectory, slight increase in capex coupled with increases in tax revenue, landowner payments, O&M expenses & Renewable Energy Certificate costs between 2021 & 2030

Source: EIA; LBNL; NREL Cambium, ATB (https://www.nrel.gov/disclaimer.html); Rystad; Texas Comptroller; BLM; BEA; Expert interviews
Potential future industries that can be built in Texas

Emerging technologies require cost-competitive renewable power, supportive permitting, and a skilled workforce.

1. IEA NZE scenario calls for 325 m tH2/y of Green H2 in 2050; IEA 2050 global demand for direct air capture (removal) = 630 MtCO2/yr; IEA NZE scenario estimates demand for sustainable aviation fuel of 5-7 mboe/day of which PtL kerosene is expected to comprise 40%.
   2. Est. 2022 Texas solar and wind capacity ~ 50 GW

Capturing 10% of 2050 global demand requires an (X) increase in today’s Texas renewables capacity:

- **Green Hydrogen**: >5x
- **Direct Air Capture**: ~2x
- **Synthetic Aviation Fuels**: ~3x

Source: NREL (https://www.nrel.gov/disclaimer.html); IEA; Destination2050 Report