Renewable Energy in Mexico’s Northern Border Region

Wilson Center – Mexico Institute
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Mexico has reached 25% of installed capacity from renewables mainly through the growth of wind energy.

35% generation goal by 2024 can be achieved through a combination of technologies and business models.

Renewable Energy Today

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Installed capacity</td>
<td>60,072 MW</td>
<td>62,233 MW</td>
</tr>
<tr>
<td>Hydroelectric</td>
<td>19.3%</td>
<td>20%</td>
</tr>
<tr>
<td>Wind energy</td>
<td>0.7%</td>
<td>3.1%</td>
</tr>
<tr>
<td>Geothermal</td>
<td>1.6%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Solar</td>
<td>0%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Biomass and biogas</td>
<td>0.1%</td>
<td>0.3%</td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>2028</td>
</tr>
<tr>
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12,362 MW of wind

1,827 MW of solar
New Electric Industry Law

- Reform Creates Late 20th Century Electric Market:
  - Centralized planning
  - Wholesale, commercialization and retail
  - National clean energy targets
  - Large scale infrastructure and players
  - Distributed energy not fully taken into account
  - Green package stuck in Senate
  - Local governments still play a minor role in Mexico
Mexico’s Northern Border

- The six border states are an economic powerhouse:
  - **22%** of Mexico’s **GDP**
  - **33%** of electricity **use**
  - **38%** of electricity **generation**

- But **95%** of their installed capacity is from **fossil fuels**
Electric Control Regions
Baja California

• Most “dynamic” electricity market in the whole country (export-import, self-supply)
• Most important geothermal project with 570 MW
• First state to own and operate a 10 MW wind farm
• Recently announced 150 MW project to supply state government
Baja California

Eighth largest state in Small and Medium scale solar with **2.6 MW** accumulated capacity

<table>
<thead>
<tr>
<th>Year</th>
<th>Commercial</th>
<th>Residential</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>2011</td>
<td>85.19</td>
<td>3.97</td>
</tr>
<tr>
<td>2012</td>
<td>130.71</td>
<td>115.688</td>
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<tr>
<td>2013</td>
<td>397.94</td>
<td>949.083</td>
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<tr>
<td>2014</td>
<td>152.17</td>
<td>773.579</td>
</tr>
</tbody>
</table>

**Additional Capacity (kW)**

![Additional Capacity Chart](chart.png)
Chihuahua

- State with the highest energy intensity for its GDP = 30.53 GWh/million MXP
- Largely dominated by fossil fuels representing 98.6%
- Only 1.4% from hydroelectric and biogas, including second largest municipal landfill biogas project
Chihuahua

Chihuahua 2014

Chihuahua 2020

- Fossil Fuels
- Hydro
- Solar
- Biogas
Chihuahua

Third largest state in Small and Medium scale solar with **6.9 MW** accumulated capacity, similar to installed biogas capacity
Coahuila

- Relies the most on **coal power** plants for electricity generation (90.1%)
- Wind power to supply the mining industry with a projected installed capacity of **550.6 MW**
- The state government and the municipalities of Torreon and Matamoros are expected to be supplied by a **20 MW** solar project
Coahuila

Coahuila 2014

Coahuila 2020

Fossil Fuels  Hydro  Solar  Biogas  Wind
Coahuila

Fourth largest state in Small and Medium scale solar with \textbf{3.9 MW} accumulated capacity

<table>
<thead>
<tr>
<th>Year</th>
<th>Commercial</th>
<th>Residential</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>2011</td>
<td>265</td>
<td>504</td>
</tr>
<tr>
<td>2012</td>
<td>115</td>
<td>208.75</td>
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<tr>
<td>2013</td>
<td>556.475</td>
<td>824.5</td>
</tr>
<tr>
<td>2014</td>
<td>267.27</td>
<td>1168.608</td>
</tr>
</tbody>
</table>
Nuevo Leon

- **100%** of public service* electricity from **fossil fuels**
- Installed capacity from self-supply projects adds up an additional 1,175 MW
- **60.56 MW** (biogas and wind) from renewables for state and municipal government off-takers
- Self-supply market is actually larger, with large corporations involved in energy generation projects elsewhere (mainly **wind** in the state of Oaxaca)
Nuevo Leon

- Nuevo Leon 2014
- Nuevo Leon 2020

Fossil Fuels
- Biogas
- Wind
Nuevo Leon

Second largest state in Small and Medium scale solar with **12.1 MW** accumulated capacity, with 7 MW installed in 2014 alone

<table>
<thead>
<tr>
<th>Year</th>
<th>Commercial</th>
<th>Residential</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2011</td>
<td>5.2</td>
<td>30</td>
</tr>
<tr>
<td>2012</td>
<td>701.78</td>
<td>1530.25</td>
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<tr>
<td>2013</td>
<td>577.81</td>
<td>2084</td>
</tr>
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<td>2014</td>
<td>713.17</td>
<td>6496.27</td>
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</table>
Sonora

- **94%** of its installed capacity relies on fossil fuels
- **163.7 MW** of hydroelectric power
- The vast majority of the **1190 MW** of solar projects are under the small power producer legacy modality, with some for self-supply to automobile industry and municipalities
- Mining industry developing **37 MW** of hydroelectric power
Sonora

Fossil Fuels  Wind  Hydro  Solar

Sonora 2014  Sonora 2020
Sonora

Tenth largest state in Small and Medium scale solar with **2.4 MW** accumulated capacity

<table>
<thead>
<tr>
<th>Year</th>
<th>Commercial</th>
<th>Residential</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>7.3</td>
<td>5.85</td>
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<tr>
<td>2011</td>
<td>211.38</td>
<td>0</td>
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<tr>
<td>2012</td>
<td>101.78</td>
<td>147</td>
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<tr>
<td>2013</td>
<td>538.205</td>
<td>366.1</td>
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<tr>
<td>2014</td>
<td>788.895</td>
<td>208.6</td>
</tr>
</tbody>
</table>
Tamaulipas

- Tamaulipas is the top electric power generator state in northern Mexico, and second after Veracruz.
- Responsible for **12.7%** of the national public service generation
- **97.6%** of installed capacity if from fossil fuels
- **33 MW** of hydroelectric power and a recently inaugurated private **54 MW** wind farm
Tamaulipas

- Fossil Fuels
- Sugarcane Bagasse
- Wind
- Hydro

Comparison between Tamaulipas 2014 and Tamaulipas 2020.
Eighteenth largest state in Small and Medium scale solar with 1.3 MW accumulated capacity, of which more than half was installed in 2014 alone.
A New Border?

![Graph showing energy sources and percentages over time](image-url)
Energy at the Border

• Plentiful geothermal, wind and solar resources.
• All have set up an energy agency, commission or office.
• Municipalities of Nuevo León were the first to embrace renewable energy (landfill biogas) for public lighting
• Baja California is a rare example of a subnational government that owns and operates a major wind project.
Obstacles and Challenges

- Regulatory – permitting and interconnection agreements
- Land Use – known issue for developers
- Financial – unclear incentives beyond CEC
- Security – slowdown in some high-potential areas such as Tamaulipas
- Transmission capacity – permitting for large scale projects
Policy Recommendations

• Renewable energy generation goals at the regional level (for each electricity control regions) through complementary mechanisms

• Set aside a percentage for small-scale Clean Energy Certificates with to promote distributed generation (similar to Australia)

• Strengthen state government energy agencies and encourage the participation of state-level institutions
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