Wind as Renewable Energy Option for Rural Southwest

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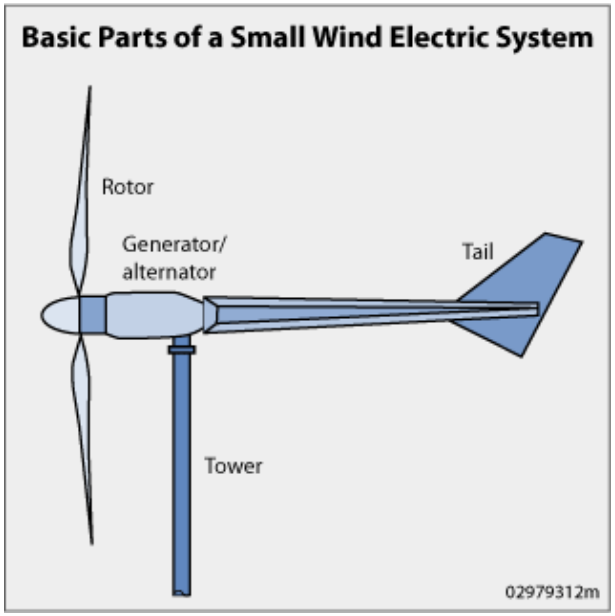
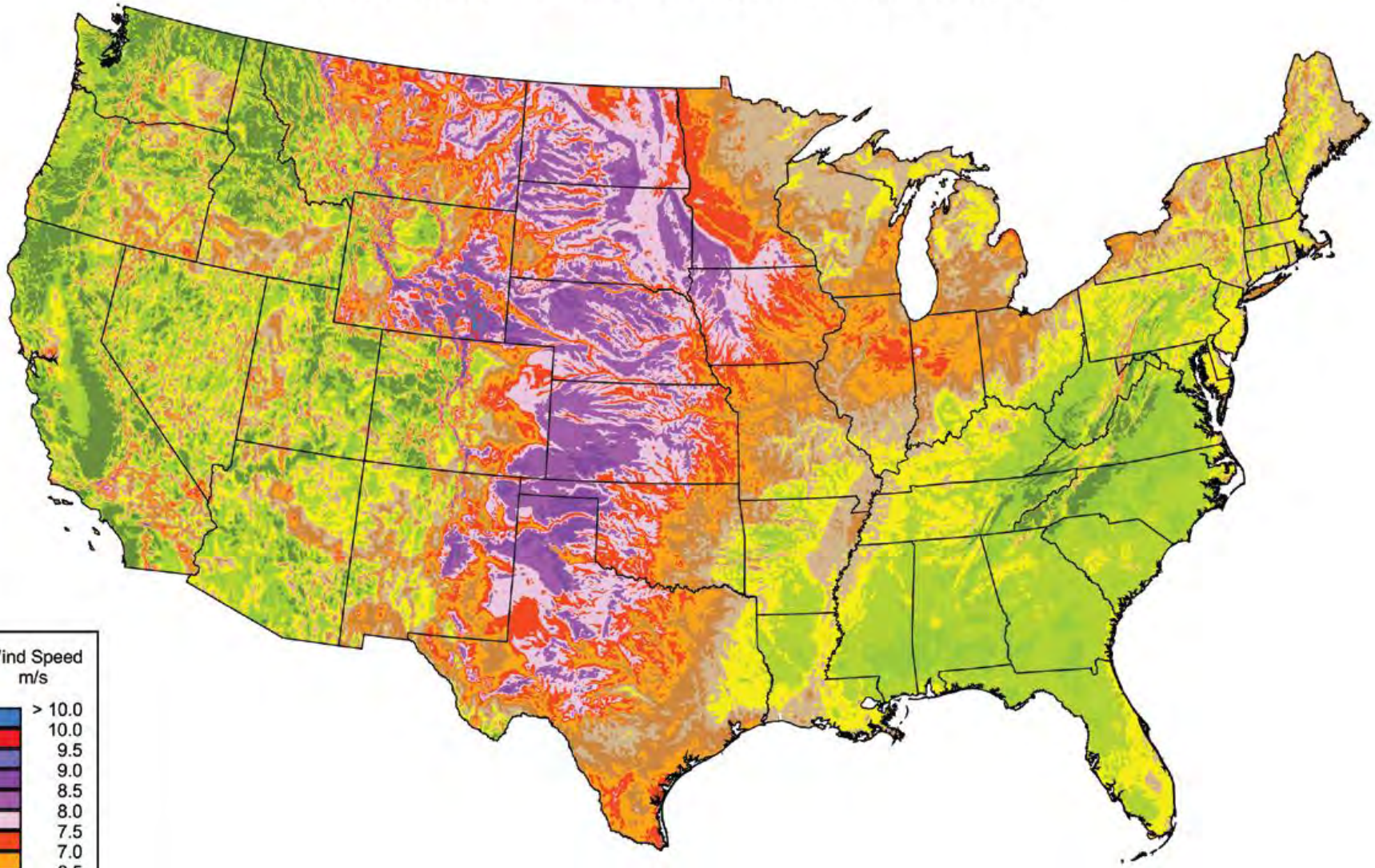
Objective

- To understand how certain factors influence the installation rate of small wind turbines
- To evaluate the effectiveness of the New York small wind incentive program



United States - Annual Average Wind Speed at 80 m



Wind Speed
m/s

- > 10.0
- 10.0
- 9.5
- 9.0
- 8.5
- 8.0
- 7.5
- 7.0
- 6.5
- 6.0
- 5.5
- 5.0
- 4.5
- 4.0
- < 4.0

Source: Wind resource estimates developed by AWS Truewind, LLC for windNavigator®. Web: http://navigator.awstruewind.com | www.awstruewind.com. Spatial resolution of wind resource data: 2.5 km. Projection: Albers Equal Area WGS84.

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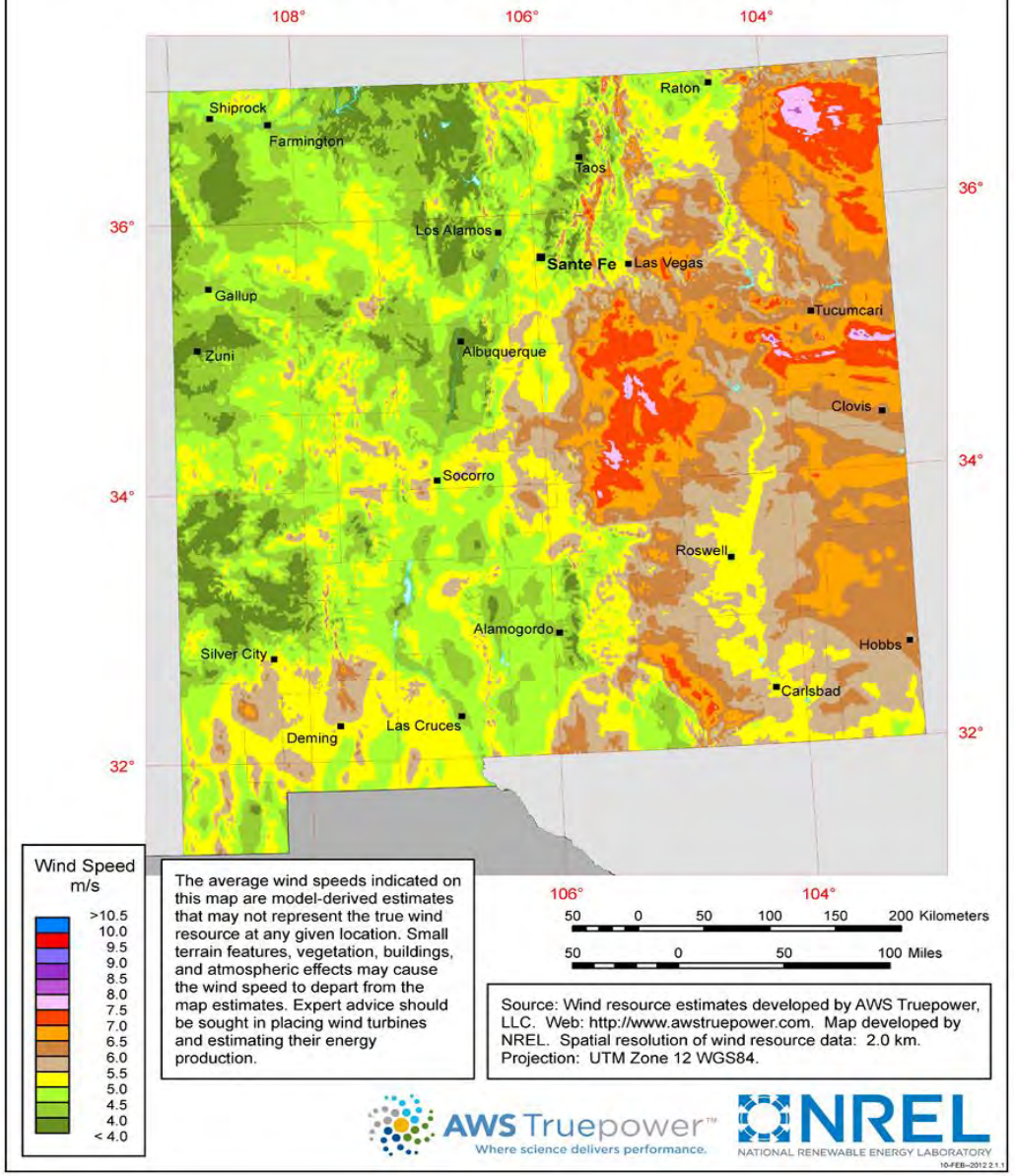
New Mexico - Annual Average Wind Speed at 30 m



The average wind speeds indicated on this map are model-derived estimates that may not represent the true wind resource at any given location. Small terrain features, vegetation, buildings, and atmospheric effects may cause the wind speed to depart from the map estimates. Expert advice should be sought in placing wind turbines and estimating their energy production.

Source: Wind resource estimates developed by AWS Truepower, LLC. Web: http://www.awstruepower.com. Map developed by NREL. Spatial resolution of wind resource data: 2.0 km. Projection: UTM Zone 12 WGS84.

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Initial Findings

Initial findings for New York – 169 Installations

	Size (kW)	Cost	Incentive	Height (ft)	kWh Output	Capacity Factor	Payback period
Min	1	$13,000	5%	45	1,357	2%	4
Average	9.5	$71,885	46%	117	11,428	14%	23
Max	20	$181,500	83%	140	35,621	29%	282

(Source: New York State Energy Research and Development Authority)

Initial findings for California – 472 Installations

	Size (kW)	Cost
Min	0.4	$2,204
Average	7.2	$40,266
Max	20	$141,822

(Source: California Energy Commission)

Previous Research

- Jacobsson and Johnson (2000) highlight the importance of social networks that aid in the diffusion of new renewable technologies
- Durham et al. (1988) demonstrate that the likelihood of solar hot water heater installation increases with some level of college education and household size
- Rothfield (2010) finds that if the consumer faces a high electricity price they are more likely to install PV panels

Previous Models

- Durham et al. (1988) refer to consumer maximization theory to develop a probit model that predicts the probability of installing solar hot water heating
- Rothfield (2010) studied the probability of installing photovoltaic panels
- Small wind is comparable to solar PV panels, for this reason the Durham el al. (1988) and the Rothfield (2010) models will be extended to small wind turbines

Theoretical Framework

$$WIND = \beta_0 + \beta_1 POP + \beta_2 WHT + \beta_3 YOU + \beta_4 MID + \beta_5 OLD + \beta_6 TOT + \beta_7 CAP + \beta_8 EDU + \beta_9 INC + \beta_{10} CI + \beta_{11} EP + \beta_{12} EC + \varepsilon$$

Variables for Analysis

Variable	Abbreviation	Description
Population	Pop	Total population in a given zip code
White	Wht	Percent of population that is White alone, non-Hispanic
Young	You	Percent of population that is between 25 and 44 years of age
Middle	Mid	Percent of population that is between 45 and 64 years of age
Old	Old	Percent of population that is over 65 years of age
Household	Tot	Total average household size
Income	Cap	Per capita income (dollars)
Education	Edu	Population 25 years and over with bachelor's degree or higher
Incentive	Inc	Federal and state incentive (%)
Cumulative Installs	CI	All installs in a given location up to but not including the current period
Electricity Price	Ep	Average state retail electricity price ($)
Electricity Consumed	Ec	Average monthly electricity consumption by state (kWh)

Data

- Installation data - energy departments respective states
- Wind speed data - New Mexico Climate Center (http://weather.nmsu.edu/climate/)
- U.S. Census
- Energy Information Administration
- National Renewable Energy Laboratory
- Turbine model information - manufactures websites

Economic Incentives

Summary of Residential Wind Incentives and Rebates for New Mexico

State/Region/Utility	Wind Incentive or Rebate Description
United States	Federal Tax Credit (30% of Cost at Installation)
New Mexico	NM Renewable Energy Production Tax Credit ($0.01 per kilowatt-hour of energy produced)
NM Utility: El Paso Electric Co	El Paso Electric Co REC Purchase: $ 0.04/kWh x 8 yrs: to 2020 (<10 kW)
NM Utility: El Paso Electric Co	El Paso Electric Co REC Purchase: $ 0.02/kWh x 8 yrs: to 2020 (10 - 100 kW)

(Source: http://www.dsireusa.org/)

Results & Conclusion

- Results are pending
- Critical information for policy makers to keep making sustainable actions and for home owners to be energy independent
  - Lacking installation data