

## ABSTRACT

Renewable energy may seem like a simple source of energy, but there is a variety of detailed research required for sustainable development.

We aim to find the most suitable location in Colorado for a wind farm.

Using ArcGIS we performed many experiments to find the best location, resubmitting in Limon, Colorado/

This research helps display the importance of renewable energy standards and development.

## INTRODUCTION

For our study, we are examining the most suitable site for a windmill farm in Colorado based on the following criteria:

1. Located in the state of Colorado
2. In counties where the population as of 2010 is at least 20,000
3. In areas where the wind power class is at least 4
4. Within 10 miles of existing power lines that have a capacity of at least 400 kilovolts (kV)
5. Within 5 miles of existing wind farms containing turbines where the rotor diameters span at least 100 feet

We hypothesize that the most suitable area for a windmill farm will be near a large city, due to population density. Our results supported our hypothesis, indicating a town southeast of Denver as the prime location to place a wind farm.

This research is crucial to understanding influences into the production of renewable energy and expanding it.

### Benefits outside of environment:

- Public Health
- Profit at a low-cost
- Economic Development
- Reliability

people fear that renewable energy is unreliable

Renewable Energy standards are yet to be required nationally  
Colorado's RES standards and Goals:

10%-20% of energy must be from a renewable source, varying by size of facility.

Serve 100% renewable energy when providing to 500,000+ people

### Sources of Renewable Energy:

- Wind Power
- Biomass
- Solar Power
- Geothermal
- Hydropower
- Tidal

## RESULTS

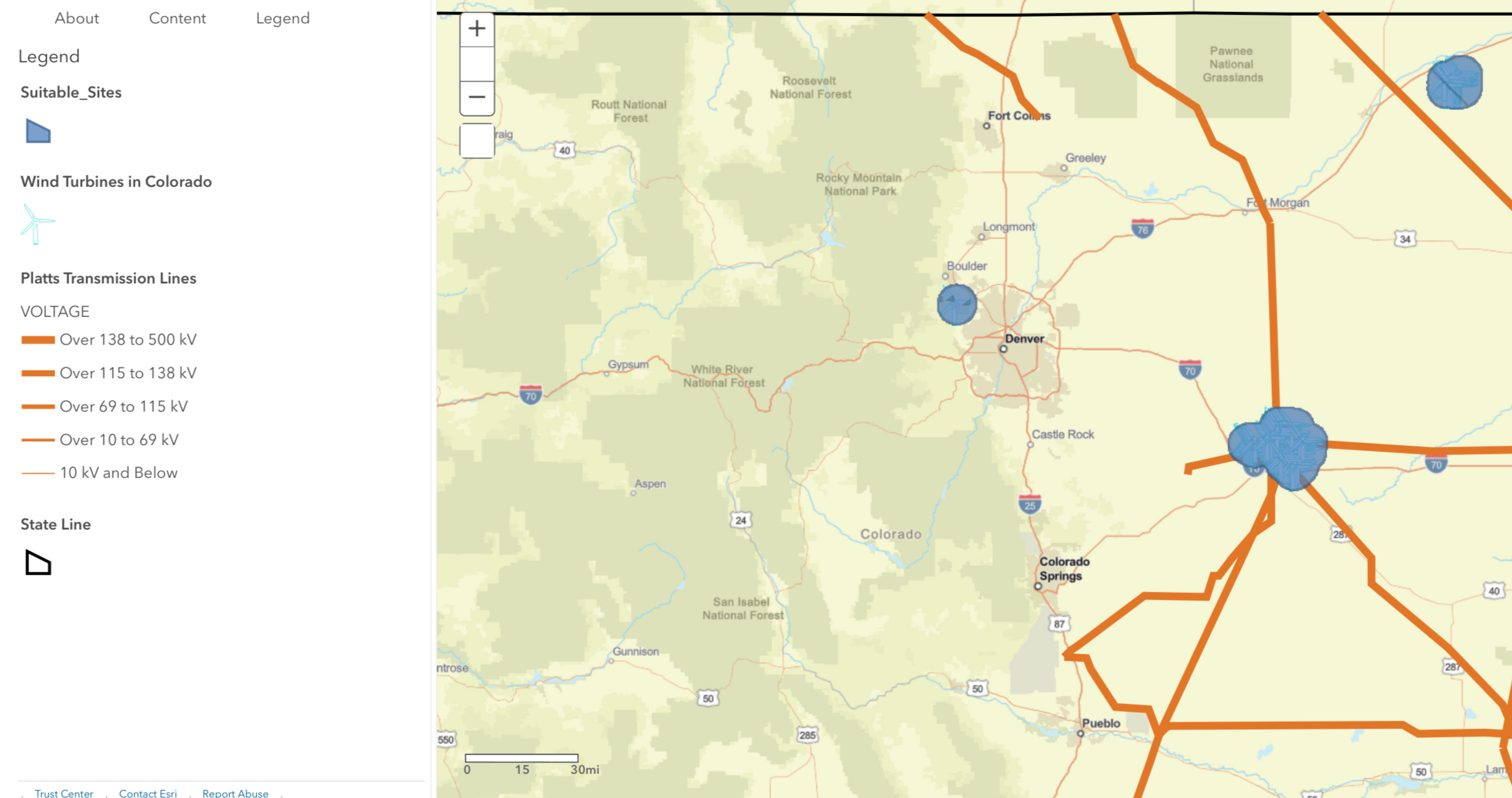


Figure 1. Suitable sites in Colorado matching all given criteria. This map shows Fleming and Limon, Colorado

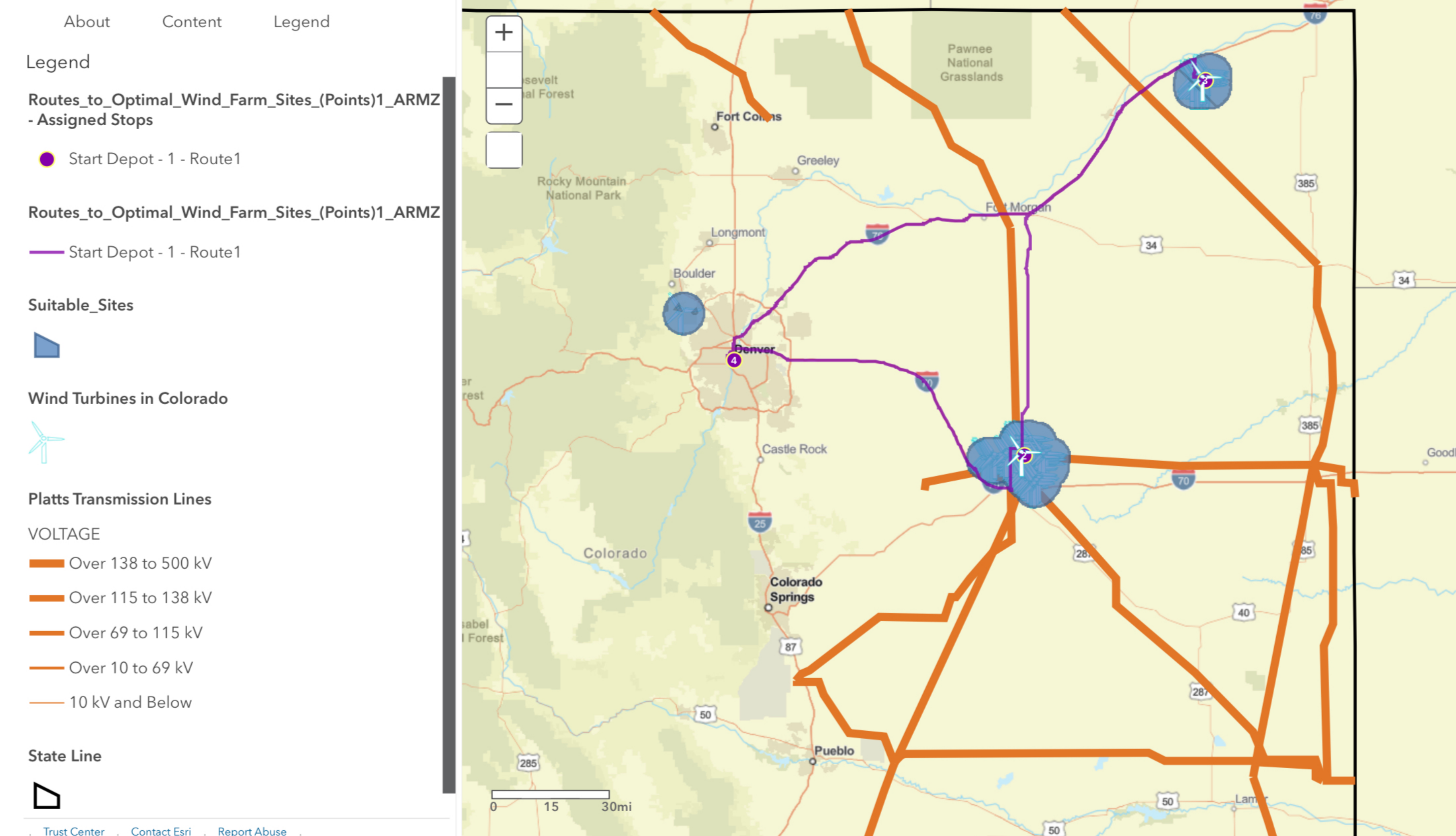


Figure 2. Routes to suitable sites, based on nearby population. Route starts at Denver capital and travels to both sites.

## Materials and Methods

Using ArcGIS, the following data was sourced:

wind class power, power lines, rotor diameter, population, and distance were all used to determine the most suitable location.

Techniques used:

- Creating expressions
- analysis, buffers
- overlay layers
- routing

Procedure:

1. Applying filters to show suitable data for wind power
2. Ran an analysis with expression to display counties with population range
3. Added filters to transmission lines and rotor wind turbine and rotor diameter
4. Added buffers around transmission lines and wind farms
5. Performed analysis to unify transmission lines and wind farms
6. Ran a final analysis to unify both prior analysis, resulting in suitable sites
7. Finally, the last analysis analyzed the routes to the sites from Denver, CO.

## Discussion

Limon showed to be most suitable based on given criteria and convenience

Transportation is a shortcoming

Roadways to Fleming are more accessible.

### Future Research

- Suitable locations for other sources of renewable energy
- Requirements for other sources of renewable energy
- Influence of transportation

## REFERENCES

- Megan Cleveland, L. S. (2018). *State Renewable Portfolio Standards and Goals*. National Conference of State Legislatures. Retrieved from <https://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx>.
- Kariuki, D. (2018). *Barriers to renewable energy technologies development*. Energy Today. Retrieved from <https://www.energytoday.net/economics-policy/barriers-renewable-energy-technologies-development/>.
- Kerski, J. (2021). *Perform a site suitability analysis for a new wind farm*. Learn ArcGIS. Retrieved from <https://learn.arcgis.com/en/projects/perform-a-site-suitability-analysis-for-a-new-wind-farm/>.
- Solar Energy Industries Association (SEIA). (2021). *Renewable energy standards*. SEIA. Retrieved from <https://www.seia.org/initiatives/renewable-energy-standards>.
- Thoubboron, K. (2021, December 3). *Advantages and disadvantages of renewable energy*. Energy Sage. Retrieved from <https://news.energysage.com/advantages-and-disadvantages-of-renewable-energy/>.
- Union of Concerned Scientists. (2017). *Benefits of renewable energy use*. USCUSA. Retrieved from <https://www.ucsusa.org/resources/benefits-renewable-energy-use>.

## ACKNOWLEDGEMENTS

We express gratitude to Lynn University, especially Dr. April Watson.