

# SUPERCOMPUTING CHALLENGE: FINAL REPORT

## NEW MEXICO ENERGY SUSTAINABILITY AND CO<sub>2</sub> FOOTPRINT REDUCTION

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Our team has studied New Mexico Energy Sustainability in terms of alternatives for generating reliable and sufficient energy with little CO<sub>2</sub> footprint. Presently New Mexico is an energy exporting state. We generate 30 billion kw-hrs of electricity per year. We consume about 20 billion kw-hrs and export the remaining power to California. We rely almost exclusively on fossil fuels (coal) to generate electricity. Our objective is to develop strategies for optimum mix of future energy sources.

We used an agent based simulator named Star Logo TNG to model how we can change the way New Mexico gets its energy from coal to wind and nuclear energy. The results of our simulation were practically what we had predicted. The results clearly showed that wind energy by itself will not be able to meet New Mexico's energy needs. Although it may be capable of generating sufficient energy per year, its intermittency means unreliable energy supply. Instead a combination of nuclear energy and wind energy were best able to provide reliable energy to power the simulated New Mexicans with little or no CO<sub>2</sub>. We have concluded that we should use both a blend of both nuclear energy and wind energy to power New Mexico in the future. Other alternate is to continue operation of two of the existing coal plants together with wind energy (+ 5% energy storage). This provides reliable energy supply but with two-thirds reduction in CO<sub>2</sub> emissions. We examined numerous other alternatives and the overall results were simulated

Energy consumption and generation data were obtained by combining data from DOE Energy Information Agency (EIA) and State Resource data. The characteristics of wind energy (its intermittency and strength) were obtained from National Renewable Energy Laboratories (NREL) website. We used the simulation Superyo 01 (without storage) and Superyo 002 (with storage) to get our groups' results. Also we used a graph on both of our simulations named New Try to extract data from the simulation. Then we saved the data on Microsoft Excel so that we could easily analyze the data. One of our most significant achievements on this project is the fact that we were able to predict the outcome of the simulation correctly. Another significant achievement is that the group members learned how to make a simulation on Star Logo TNG.

We have been helped by many people and organizations. We would like to give the most thanks to Maureen Dombrowsky who helped us fix our simulation, Venkat Dasari who was our team mentor and helped our team with research and making the simulation, and our teacher Andrea Spence who organized most of our team's work and helped us with the presentation expo and helped us when we needed organizational help. Finally we would like to thank MIT for making Starlogo TNG, and the Supercomputing Judges David Kratzer and David Jankey for their comments and help.