

#63

Los Alamos Middle School

Team Members

Nikita Belousov

Steven McCrory

Teacher

Robert Dryja

Project Mentor

No Mentor

### **Executive Summary**

We researched on the environmental effects of a train and car and which one is better and put it into our model. We narrowed down the project down so that it is not very realistic right now. We used only one programming language to show how four different cars, a hybrid, minivan, truck, and regular car, emit carbon dioxide and show which one is more environmentally friendly. We learned a programming language and became better programmers. We hoped to include economics into our model, but we got our hands full quickly with making the environmental half but, if we had been able to finish the environmental part of the model and had been able to finish the economic part we would have a way for there to be a cost going to Albuquerque and Santa Fe for both transportations. We would also incorporate other aspects into the model, such as; natural disasters costs, initial cost, tickets(train only), gas(car only), and repairs. To the best of our knowledge this is the first models of the rail runner.

#### Statement of the Problem

Human activities are causing the release of a tremendous quantity CO<sub>2</sub> into the atmosphere. CO<sub>2</sub> traps heat and for that reason is called a "greenhouse" gas. Climate scientist believe this is the global warming which has been accelerating for these past decades.

Global warming, if it continuous, will have bad effects on human beings, other species, and the environment. For this reason there are many efforts under way to reduce the amount of carbon dioxide released.

Our project is a specific example of these efforts. Our three objectives were:

- 1) To determine whether traveling by train or car releases less carbon dioxide per traveler.
- 2) To model the rates that CO<sub>2</sub> is produced and destroyed under various scenarios.
- 3) To improve our computer modeling skills.

#### DESCRIPTION OF THE METHODS USED

Last December, a commuter train called the Rail Runner began operating between Santa Fe and

Albuquerque. This gave us the opportunity to test the relative CO<sub>2</sub> emissions for a traveler between these two cities by train as opposed to driving a car. In order to study this problem we used several assumptions:

- 1) The seating capacity of a Rail Runner Commuter train is 486. We actually took a round trip on the Rail Runner during which we counted the passengers and the seats on the train.
- 2) The train carries a capacity crowd. This is also based on our trip; during which there was a larger number of people than seats.
- 3) The train emits a 6.6 miles of carbon dioxide per mile during a 50 mile (one way) trip. This is 330 pounds of carbon dioxide. The number of people in the train divided into that amount is the amount of carbon dioxide per person which comes out to 0.63 pounds of CO<sub>2</sub> per person for a full one way trip.
- 4) If the train was not available then all of these people would drive from Santa Fe to Albuquerque.

5) We assume that each person drives separately. This based information on the New Mexico Department of Motor Vehicles Website.

For our model we are using a agent based modeling system to model how each transport in our model emits CO2. A agent based model is a model that can simulate many objects, or agents follow rules that you put into the program. We choose a agent based program over a math based program, because our group is not advanced enough in math to make a program for this program.

The following table describes the agents that we used in our modeling and the characteristics of each:

#### AGENTS USED CHARACTERISTICS

Trains Consume Oxygen and emit Carbon Dioxide

Cars Consume Oxygen and emit Carbon Dioxide

Carbon Dioxide Produced by Trains Enters the atmosphere; causes global warming

Carbon Dioxide Produced by Cars Enters the atmosphere; causes global warming

Trees Consumes CO2 during photosynthesis

Oxygen Emitted by trees

#### RESULTS:

Our results were:

#### CONCLUSIONS

#### SOFTWARE, REFERENCES, TABLES:

Our program was Star Logo. We used it because it is a beginner level modeling program. It's one of the most visual programs that we can use right now and there many local mentors that can help us with programming. We need to increase our mathematical and programming skills before we use a more complicated programming language.

OUR MOST Significant Finding:

Description of our problem:

Our main purpose for this project is to help people realize what is more environmentally friendly that it's better to use trains than cars if you want to save the environment. This very important problem in our modern world. We also could improve the income of the Rail Road Company by giving this them this program to fix and modify so that they can show what that a train is more environmentally friendly, so that people who like to do whatever to save the environment would ride the train so that means that more people will ride the train and make the rail road company get more money.

#### TeamWork

The team 63 has two members in it. The two members are Steven McCrory and Nikita Belousov. Nikita is a new member to the super computing challenge and he is learning Star Logo this year. Steven McCrory has been in the super computing challenge last year. Steven McCrory is this team's researcher, spellchecker, and programmer. Nikita Belousov is the team's researcher, emailer, and programmer.

#### CONCLUSION

1. The Rail Runner emits less carbon dioxide per person, per trip (between Albuquerque and Santa Fe) than any automotive vehicle that we studied.
2. Different vehicles produce different amounts of CO<sub>2</sub>
3. The amount of CO<sub>2</sub> varies from two to four times as much as the emissions from the train.
  1. Pickup trucks emit four times as much CO<sub>2</sub> per person as the train
  2. Minivans emit three and one half times as much CO<sub>2</sub> per person as the train
  3. Regular passenger cars emit three times as much CO<sub>2</sub> per person as the train
  4. Hybrids emit twice as much CO<sub>2</sub> per person as the train

#### Future Work

In the future we are planning to continue with this project and try to improve it until we have finished adding in the financial part of this program. After we accomplish this we will start a new model on a different subject.

#### **Acknowledgments**

We would like to thank our parents GATE teacher Mr. Dryja