



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) Avni Singhal	Project Number J1024
Project Title Greener Cleaner Cars Using Exhaust Filtering	
Abstract Objectives/Goals The purpose of my project is to reduce carbon dioxide emissions from gasoline cars by capturing and consuming it, using my apparatus. Methods/Materials My apparatus makes use of lime water (calcium hydroxide and water) and bubbles the exhaust air from the car through it consuming the CO ₂ in the following reaction: $\text{Ca(OH)}_2(\text{aq}) + \text{CO}_2(\text{g}) \rightarrow \text{CaCO}_3(\text{s}) + \text{H}_2\text{O}(\text{l})$. The byproducts are calcium carbonate and water. Other than the lime water consumable, the materials to construct my final apparatus include a plastic container, pipes of various types, and diameters and everyday tools. Results My first model captured 2.5gm, while my second model captured 66gm of CO ₂ in 5 minutes. The reason for the dramatic increase was that there was significantly more surface area (due to the 36 instead of 1 locations from where the gas was released), that allowed more reaction to happen. The compartments added in the third and fourth designs ensured that the lime water was positionally-stable to react at all times, while the car moved. An unexpected but beneficial result was that I also captured particulate matter, which is a major cause for respiratory health concerns. In the third model, these particles were getting trapped and accumulating into the pipes at the bottom of the chamber. It had the potential of causing serious car safety problems if the pipes eventually became clogged and blocked the car exhaust. Therefore, in the fourth model, I addressed this safety concern by driving the exhaust air top-down instead of bottom-up. Conclusions/Discussion There were many learnings during the project that need further exploration. Exhaust gas emitted from cars can get up to hundreds of degrees, and a lot of water can be lost to evaporation alone. To stop this, a radiator can be used in future models. The main byproduct of my reaction is calcium carbonate which, once filtered for particulate matter, can be used for medicine, classroom chalk, and to neutralize soil. How the byproduct would make it to those uses needs to be explored. Finally, effectiveness of capturing particulate matter needs to be explored and improved.	
Summary Statement The project is about reducing carbon dioxide emissions from gasoline cars.	
Help Received Uncle helped with calculations; Dad helped with models; Mom helped with editing	