Are NEVs Really Cleaner?

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LINCOLN, California -- People often tout the environmental friendliness of Neighborhood Electric Vehicles (NEVs) as a top reason to buy. Unfortunately, it's all too easy to forget that much of our energy comes from "dirty" sources, such as coal and gas. Aren't NEVs--and electric cars in general--simply shifting the pollution from one community to another? In short, no.

In the United States, our electricity comes from a variety of sources. Clean sources, such as solar and wind, have no adverse environmental impact. On the other hand, coal and gas power plants release pollution and greenhouse gases. When a NEV is plugged in, it's getting electricity from the cocktail of sources that power the grid. While an electric vehicle emits no pollutants or greenhouse gases when driven, the electricity used for charging is typically generated in power plants that pollute.

On the other hand, much of the pollution from gas-powered cars is generated while driving. A car's internal combustion engine emits pollutants at different rates. When the engine first starts, the catalytic converter is not working at its optimum efficiency. Harmful emissions are produced at a higher rate after a cold start--and are reduced after the engine reaches its normal operating temperature. That means short trips around town will produce a greater percentage of emissions per mile than longer trips. Additionally, the refinement, transportation, and distribution of gasoline produces pollution before the gas is even burned in a car's engine.

What Makes Emissions Bad?

So what exactly is this "bad stuff" that constitutes pollution and greenhouse gases? Listing all of the gases and their concentrations would surely lull most readers to sleep, so we'll take a look at only two of the most significant offenders.

Carbon Dioxide (CO2) is a colorless, odorless gas. At normal levels, CO2 is essential to the balance of life. After all, when we exhale CO2, plants absorb it and release oxygen as a by-product. The problem is that too much carbon dioxide in the atmosphere acts as a blanket around the earth--it keeps the warmth in, and the cold out. Thus, the accumulation of excess CO2 in the atmosphere is a major contributor to global warming.

Nitrogen Oxides (NOx) are a family of various gases that are produced during combustion. They react with other compounds in the atmosphere to create the brown clouds of smog we're so accustomed to seeing in the summer.

NEVs: Clearly Cleaner

What quantities of these gases are released per mile driven in a NEV, versus a gasoline powered car? In the chart below, we'll compare the emissions of an internal combustion engine with those of a power plant generating enough electricity to move a NEV the same distance.

Here in California, our electricity is much "greener" than that of the nation as a whole. With tougher DMV requirements, our gasoline cars tend to be slightly cleaner as well. To illustrate the point, we'll provide emissions figures for both California, and the country as a whole.

	CO2 lbs/mile	NOx lbs/mile
Internal combustion engine passenger car (U.S. Avg.)	0.916	0.00306
Internal combustion engine passenger car (Calif. Avg.)	0.882	0.000903
NEV charged in an average U.S. location	0.299	0.00000428
NEV charged in California	0.136	0.000000825

Driving a NEV in California results in the emission of over six times less carbon dioxide, and over

one thousand times less nitrogen oxides when compared to driving a traditional passenger car. When compared to a truck or SUV, the reduction is even more dramatic.

Shift Emissions Into Neutral

While a NEV is significantly cleaner than a gas car, its emissions impact can be reduced to nothing through the use of alternative power sources. Rooftop solar panels (or in some areas, backyard windmills) allow for emissions-free electricity generation. With these green options, pollution doesn't factor into the equation. Residential solar and wind systems empower NEV owners to be as green as they desire.

Electric vehicle owners who want to neutralize emissions but can't afford solar have another option: charging at night. In California, power plants often run even when demand is low--and thus have excess capacity. Additionally, many utilities rely on hydroelectric power at night. By charging after 7:00 P.M., a NEV will have little or no emissions impact, and will place less strain on the power grid.

Electric motors are significantly more efficient than internal combustion engines--and they produce no emissions while driving. Even with power plant emissions considered, the environmental impact of an electric vehicle is much less than that of a gas-powered car. While NEV owners appreciate the low operating cost and convenience for local trips, the whole community benefits from cleaner air.

Crunching the Numbers

There's a lot of data to digest in order to arrive at the conclusions in this article. If you're interested in our sources and calculations, please read on.

According to the California Energy Commission's Demonstration of Neighborhood Electric Vehicles Consultant Report P600-02-020F [PDF], published on July 1, 2002, NEVs have an average power consumption of 0.223 kWh/mile under real-world driving conditions.

Page 4 of the "Updated State-level Greenhouse Gas Emission Coefficients for Electricity Generation 1998-2000 [PDF]", published by the Energy Information Administration in 2002 provides our data for average national emission of CO2 and NOx per kWh and MWh respectively. According to the report, the national average of CO2 emissions is 1.34 lbs/kWh. California emits 0.61 lbs/kWh. Looking at NOx emissions, the national average is 0.0192 lbs/MWh (0.0000192 lbs/kWh). The state average for California is 0.0037 lbs/MWh (0.0000037 lbs/kWh).

Based on these figures, we can now calculate the CO2 and NOx emissions per mile for a NEV as follows:

0.223 kWh * 1.34 lbs/kWh = 0.299 lbs/mile of CO2 based on the national average
0.223 kWh * 0.61 lbs/kWh = 0.136 lbs/mile of CO2 based on the CA average
0.223 kWh * 0.0000192 lbs/kWh = 0.00000428 lbs/mile of NOx based on the national average
0.223 kWh * 0.0000037 lbs/kWh = 0.000000825 lbs/mile of NOx based on the California average

The EPA's "Emission Facts" report (EPA420-F-00-013), published in April of 2000 provides our