Electric Vehicles (*Cont'd from front page*)

There is currently a federal tax credit of $7,500 available to those that purchase EVs; this credit was accounted for in the average cost of the vehicles in this category. While many states offer similar credits to facilitate clean fuel options, Virginia offers no such incentive. Also included in the cost of the vehicle is a level-two car charging station from Home Depot, a value of $850 for faster charging, though all EVs reviewed could charge regularly without this equipment expense.

Typically, level-one chargers are included in the purchase of EVs. A level-one charger is a standard 120-volt AC plug, able to be plugged into almost any outlet. A level-one charger will add approximately 2-5miles of range per hour of charging. Level-two chargers such as the Home Depot unit in this study require installation of equipment, a 240-volt connection, and are generally more expensive than a level-one charger. Level-two chargers will up the range of an EV to 10-20 miles per hour of charging. A level-two charger was included in the price of an EV because it is a quicker and practical charging option.

Another option for EVs is a DC fast charger, which will charge 60-80 miles of EV range in approximately 20 minutes. This type of charger is most commonly used for commercial and public-use applications similar to gas stations.

Electricity from the Grid

Since an EV would be charged using electricity at the residential rate, this study uses EIA projections for electricity prices to determine the average electricity prices for 5 and 10 year EV cost of operation costs. These averages are specific to Virginia.

Electricity from Renewables

Two renewable energy options were explored in this study: wind and solar. Three scenarios were considered for charging an EV, and for charging and EV and powering a home. Each scenario is expected to meet the needs of charging an EV or charging an EV and powering a home. See the Results section for details about various scenarios.

There is also currently a 30% Federal Tax Credit available for renewable energy installations, which was included in the calculations of cost of operation for wind and solar energy. Renewable energy costs were evaluated on a 20 year life of installation.

Source: www.bergey.com

Environmental Impact of Batteries

Hybrid and EVs both use batteries to store electrical energy. There is perceived controversy surrounding the environmental impacts of batteries and this plays into the environmental discussion of these vehicles. Batteries used in vehicles, laptops, and cellular phones are made of rare earth metals that are mined. While both hybrid electric and EVs emit less or zero CO_2, reuse and recycling of will be important advancement for the technology.

Conclusions

The study performed by VCWE and VCC at JMU clearly illustrates that the cost difference between fossil-fueled vehicles and EVs powered by the grid and with renewable sources is minimal. Though the monetary difference is nominal, the environmental benefit in terms of CO_2 emissions is considerable. This study illustrates the importance of weighing the cost benefits, the environmental impacts, and personal values when considering purchasing a new vehicle. There are many options available on the market today and a vehicle sure to meet every lifestyle. The renewable energy EV charging options may be more expensive initially, but the lack of CO_2 emissions and long term fuel cost potentials for the use of domestic renewable fuel may be enough to outweigh the added cost for a renewable installation for some people.

It should be noted also that up-front costs of renewable energy installations can often be high, and some homeowners would wish to go beyond the vehicle fuel and power an entire home with a wind or solar installation. Depending on location, geography and a number of other factors, it may be more cost-effective to install a system large enough to power the home as well as charge a vehicle.

In conclusion, the most cost-effective vehicle long-term is the EV and the most environmentally-friendly way to charge that vehicle is from solar power. These savings and benefits are seen over a 10-year ownership period of the EV. This model demonstrates that while a fossil-fueled vehicle may be less expensive in the short term, an EV charged from solar energy will be more cost effective and have less of an impact on the environment long term.

If you are interested in learning more about installing wind or solar at your home or business or for the full list of assumptions and calculations used in this study, please contact VCWE at: VAcenter4windenergy@jmu.edu.

For more information on electric vehicles and other alternative transportation fuels, please contact VCC at: aharned@vacleancitites.org or visit virginiaev.org.

Charging Your Electric Car from Clean Renewable Energy

Together the Virginia Center for Wind Energy (VCWE) and Virginia Clean Cities (VCC) created a model to examine the costs and benefits of different transportation options with fossil and renewable fuels, to enable informed decision-making for car buyers.

The VCWE provides services and resources focusing on education, outreach, and research related to wind energy. VCC assists in the improvement of the Commonwealth of Virginia's air quality, increase U.S. national energy security, and promote economic opportunity in Virginia, primarily by promoting and facilitating increased use of alternative fuels and vehicles.

This study examines the economic and environmental impacts of various types of vehicles and fuels. The environmental impact was determined solely on carbon dioxide emissions. Carbon dioxide (CO_2) is the biggest contributor to greenhouse gases in the atmosphere. Increases in greenhouse gases have been shown to correlate with an increase in atmospheric temperature. Most scientists agree that these increasing temperatures are leading to issues such as: severe weather patterns, disruptions of species distributions, and rising sea levels. Use of gasoline and diesel also represent an economic and energy security challenge, as that fuel is primarily imported, sending financial resources out of a region.

Summary of Study

This study is intended to illustrate the economic and environmental benefits of electric vehicles (EVs), especially those charged using renewable energy sources, such as wind and solar. This study compares of the cost of the vehicle, cost of operation, and the CO_2 emissions for fossil fuel operated vehicles (gas, diesel, and hybrid electric) to EVs. Within the EV category, the cost of operation and CO_2 emissions were compared using the electric grid (specific to Virginia) and to solar and wind energy.

The study assumed that the average car owner would keep a vehicle for 5-10 years and drive 13,476 miles annually. All vehicles examined were 2012-2013 automatic sedan models.

Source: www.solaronesystems.com

Vehicles and Assumptions

Vehicle cost was determined using the average MSRP value for 4-6 vehicles within each category. Miles per gallon (mpg) for each vehicle category were determined using averages of city and highway fuel economy for all vehicles in the category. Cost of operation was determined to be the amount of money required for fuel or electricity in one year (no maintenance costs included) and based on the average annual miles driven.

Vehicles Fueled With Fossil Fuels

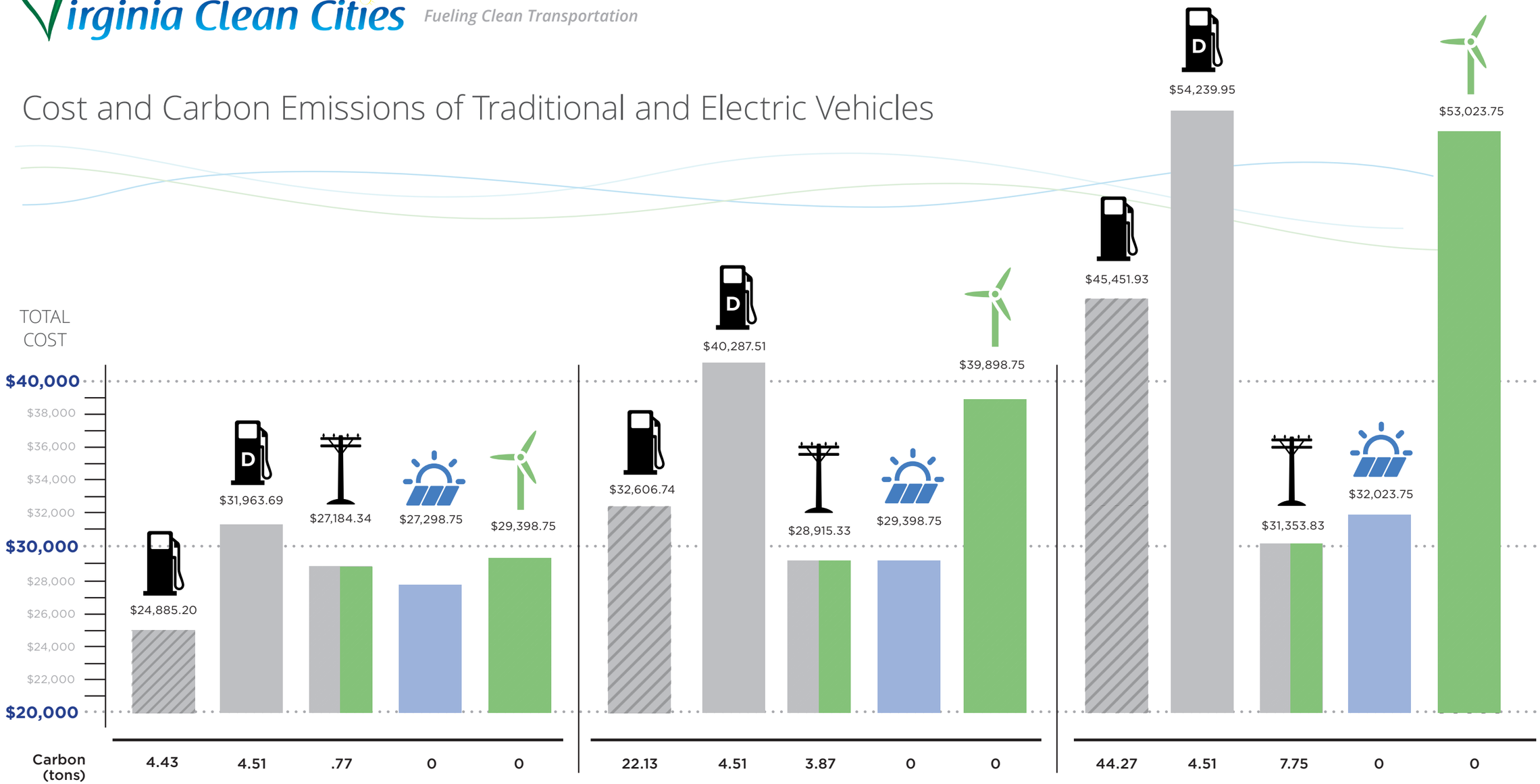
This category includes gas, diesel, and hybrid (gas-electric) vehicles. To determine fuel prices in 5 to 10 years, future price increases were assumed to follow similar trends from the past 15 to 20 years. The same process was utilized for extrapolating diesel prices over 5 and 10 years, however the data used for extrapolation spanned 1994-2013. The emissions for each vehicle category were calculated using average pounds of only CO_2 emitted for fuel type or electricity.

Electric Vehicles

EVs differ from fossil-fueled vehicles in a number of ways. This study focuses on the driving range, tax credits, and cost to charge EVs with residential electricity. EVs do not come with a mpg rating, but rather an MPGe rating and information about energy use in kWh/100 mile rating. The latter rating was used with the average miles driven per year to determine the kWh required to charge an EV annually. This calculation was used with the average cost of electricity in Virginia to determine the annual cost of operation for this vehicle category.

Virginia Clean Cities *Fueling Clean Transportation*

Cost and Carbon Emissions of Traditional and Electric Vehicles



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