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 is 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, a value of $850. These chargers provide 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, compatible with almost any outlet. A level-one charger will add approximately 2-5 miles of range per hour of charging. Level-two chargers require installation of equipment, a 240-volt electrical connection, and are generally more expensive than a level-one charger. Level-two chargers will aprovide up to 10 miles of range per hour of charging. A level-two charger was included in the price of the EV because it is a quicker and more practical charging option.

Another option for EVs is a DC fast charger, which will add 60-80 miles of EV range in approximately 30 minutes. This type of charger is most commonly used for commercial and public-use applications such as retail and 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 1, 10 and 20 years of EV cost of operation. These averages are specific to Virginia.
This study assumes a useful life of 10 years per EV so over the 20-year span of the study a person would be expected to purchase two EVs. This capital costs has been accounted for in the study.

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 an 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 a 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

Hybrids and EVs both use batteries to store electrical energy. These is a perceived controversy surrounding the environmental impacts of batteries and this plays into the environmental discussion of these vehicles. Batteries used in vehicles, laptops, and mobile phones are made of rare earth metals that have to be mined. While both hybrid electric and EVs emit less or zero CO2, reuse and recycling of batteries will be an important advancement for the technology.

Conclusions

The study performed by VCWE and VCC at JMU clearly illustrates the cost difference between fossil-fueled vehicled and EVs powered by the grid and with renewables sources is significant. The monetary difference is considerable, and the environmental benefits in terms of emissions is substantial. This study illustrates the importance of weighing the costs and benefits, the environmental impacts, and personal values when considering purchasing a new vehicle. There are many options available on the market today and vehicle designed to meet every lifestyle. The renewable energy EV charging options may be expensive with the initial capital costs, but the reduction in fuel costs and emissions over 20 years results in cost savings $27,000 for grid electricity, $31,000 for solar PV, and $6,000 for a wind system compared to a stand gasoline-powered internal combustion engine.

It should be noted that the capital costs of renewable energy installations have declined significantly since 2009 and are projected to continue decline for the foreseeable future. Depending on location, geography, and othe factors, it may be cost-effective to install a renewable energy system large enough to power your home as well as charge a vehicle.

In conclusion, the most cost-effective and most environmentally friendly vehicle over a 20-year period is the EV that is recharged from solar PV. The savings and benefits are seen over a 20- year period of ownership of the EV. This model demonstrates that while a fossil-fuel vehicle may be less expensive in the short-term, an EV charged from clean, renewable solar energy will save more money and generate a small environmental impact through reduced emissions in the long-term.

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

For more information on electric vehicles and other altenative fuels, please contact VCC at: aharned@vacleancities.org or visit www.virginiaev.org.

Charging Your Electric Car Vehicle From Clean, Renewable Electricity

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 with the goal of enabling 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, increases U.S. national energy security, and promotes economic opportunities in Virginia, primarily by promoting and facilitating the 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 is the largest contributor to greenhouse gases in the atmosphere. Increases in greenhouse gases correlate with an increase in atmospheric temperature.I A significant majority of scientists agree that these increasing temperatures are leading to severe and unpredicatable 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 from unfriendly nations.

Summary of the Study

This study is intended to illustrate the economic and environmental benefits of electric vehicles (EVs), specifically those re-charged using renewable energy sources, such as wind and solar. This study compares the original cost of the vehicle, cost of operation over 20 years, replacement of the vehicle after 10 years (useful life), and the emissions for the fossil fuel operated internal combustion engine vehicles (gas, diesel, hybrid electric) to those of EVs. Within the EV category, the cost of operation and emissions were compared using the electric grid (specific to Virginia) and to solar and wind energy.

Source: www.solaronesystems.com

This study assumes that the average car owen will keep a vehicle for 10 years and drive 13,476 miles annually. All vehicles examined were 2012-2013 automatic sedan models. The capital cost installing a residential solar or wind system was also included in the cost projection models for EVs.

Vehicles and Assumptions

Vehicle cost was determined using the average MSRP value for 4-6 vehicles within each catergory. Miles per gallon (mpg) for each vehicle category was 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

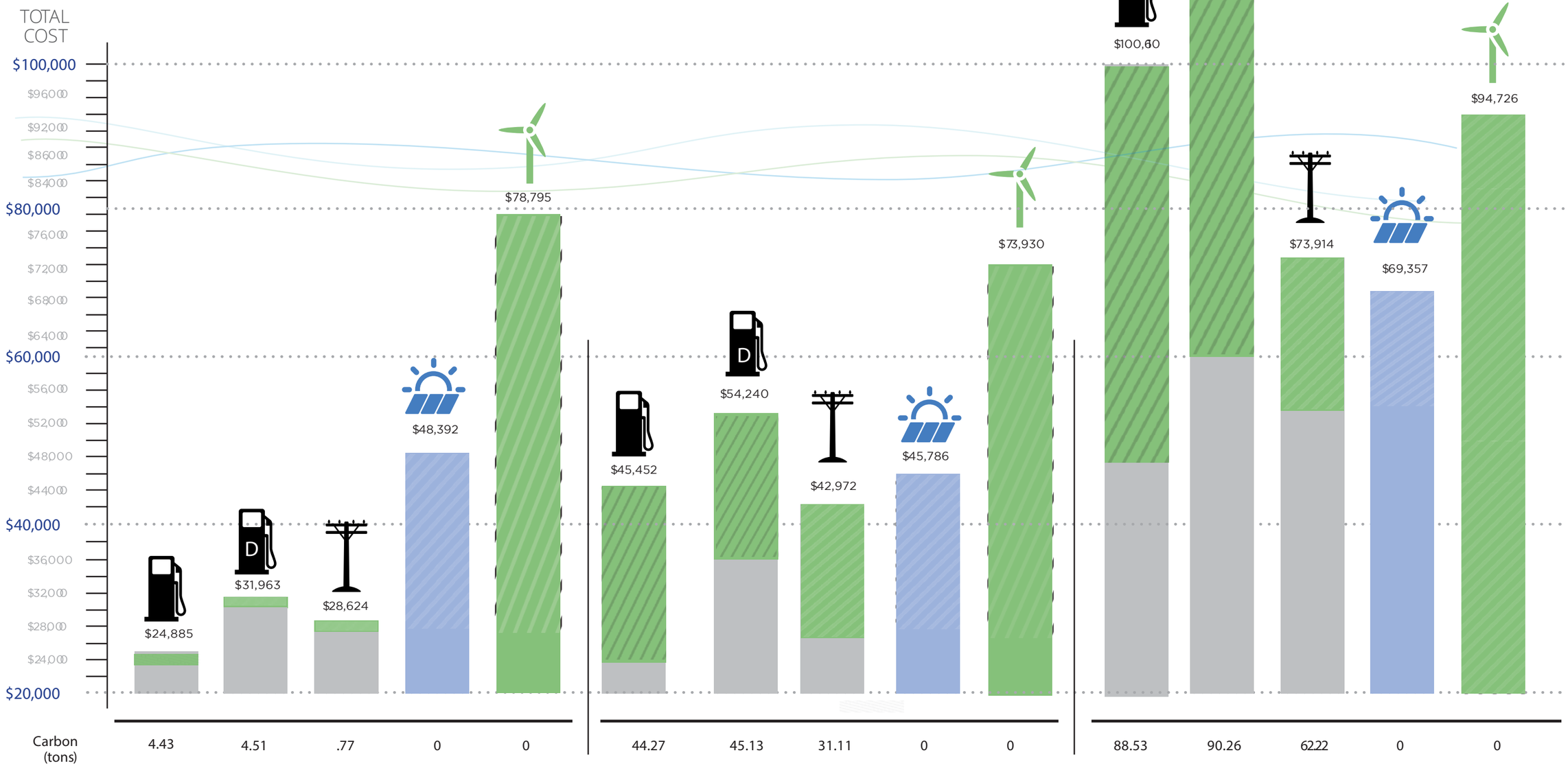
This category includes gas, diesel, and hybrid (gas-electric) vehicles. To determine gas and diesel fuel prices in 10 to 20 years, future prices increases were assumed to follow similiar trends from the past 15-20 years. The same process was utilized for extrapolating electricity prices over 20 years. The emissions for each vehicle category were calculated using average pounds of carbon dioxide emitted by fuel type or electricity.

Electric Vehicles

EVs differ from fossil-fueled vehicles in a number of ways. There is no internal combustion engine and there is not need for oil changes. 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 a MPGe (miles per gasoline gallong equivalent) rating that shows how much energy is used in a kWh/100 mile rating. The latter rating was used with theaverage miles driven per year to determine the kWh required to charge an EV annually. This calculation was used with the average cost of electricity (about $0.11/kWh) in Virginia to determine the annual cost of operation for this vehicle category.

Virginia Clean Cities *Fueling Clean Transportation*

20-Year Cost & Carbon Emissions for Fossil-Fuel & Electric Vehicles



Gas Diesel Household Grid Solar Wind

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