

# Transportation and the “Campus of the Future”



1. Employee uses smartphone to schedule automated valet vehicle delivery for meeting across campus
2. Vehicle leaves parking pod in driverless mode
3. Vehicle arrives at pickup spot and driver selects destination
4. Vehicle self-drives, giving the passenger hands-free time to work or decompress
5. Collision avoidance system automatically averts cars, pedestrians and cyclists
6. Vehicle drops passenger at destination and automatically makes next pickup or returns to parking pod
7. Vehicle self-parks and recharges

A look at how NREL staff might navigate the “Campus of the Future” using fully electric and autonomous personal mobility vehicles.

*Illustration by RNL; inset illustrations by Joshua Bauer/NREL*

## Green in Every Way

NREL’s Research Support Facility (RSF) has already received LEED-Platinum certification, along with numerous awards for its design and performance. But a truly sustainable facility is about more than an energy-efficient structure. It calls for putting green R&D into practice in every operational area—including transportation.

Alternative modes of transportation present major opportunities to conserve fuel and diminish emissions. Preferred parking spots, charging stations and bike racks in NREL’s new garage will encourage employees to use electric and hybrid-electric vehicles, carpool or bicycle. And shuttle buses have become a home-away-from-home for many staff members.

As NREL builds out its “Campus of the Future,” facility designers continue to search for new ways to reduce the lab’s energy consumption. Is there a way to provide even more sustainable choices without asking anyone to give up the flexibility of personal transportation?

Someday, electric vehicles charged with campus-generated solar and wind power might help balance lab energy loads while making it easier for staff members to get from Point A to Point B.

## One Vision of Sustainable Transportation

On loan to NREL from General Motors, the EN-V (Electric Networked-Vehicle) represents one potential vision of sustainable transportation for cities, office parks—and research campuses. Fully-electric personal mobility vehicles like this could make it possible to quickly criss-cross the NREL campus at any time, without burning fuel, producing emissions, or looking for a parking space.

The EN-V prototype features:

- Autonomous driving, parking, retrieval and charging capabilities
- Vehicle-to-vehicle and vehicle-to-grid communications through built-in Wi-Fi and GPS systems
- Operating costs 25%-30% less than typical passenger cars
- Carbon fiber body 30% lighter than traditional vehicles
- Maximum speed of 25 mph and range of 25 miles
- Turn-on-a-dime steering responsiveness
- Room for two passengers
- Skateboard chassis developed in partnership with Segway
- Wheel motors combined with dynamic stabilization technology and a lithium-ion battery

A wide range of solutions will be needed to decrease energy use while meeting NREL transportation needs. Only by integrating energy-saving buildings, vehicles and processes—at the lab and across the nation—will it be possible to go beyond net zero and deliver a negative carbon footprint.



Built-in Wi-Fi and GPS systems offer hands-free driving and communications on the go.

*Photo © GM Company*



The GMC EN-V personal mobility vehicle.

*Photo © GM Company*

### About the Center for Transportation Technologies and Systems

An arm of the only national laboratory dedicated to renewable energy and energy efficiency, NREL's Center for Transportation Technologies and Systems (CTTS) is at the forefront of R&D for tomorrow's sustainable transportation solutions. The center's innovative and integrated whole-system approach helps government, industry and other research partners develop market-ready, high-performance, low-emission, fuel-efficient vehicles, components and systems. Research at the recently unveiled Vehicle Testing and Integration Facility (VTIF) explores integrating plug-in vehicles like the EN-V with the utility grid and buildings.

For more information on CTTS and NREL's transportation R&D, see <http://www.nrel.gov/vehiclesandfuels/> or contact Terry Penney: (303)275-4434, [Terry.Penney@nrel.gov](mailto:Terry.Penney@nrel.gov).

Additional information on the EN-V can be found at <http://media.gm.com/autoshow/Shanghai/2010/public/cn/en/env/news.html>.



**National Renewable Energy Laboratory**  
1617 Cole Boulevard, Golden, Colorado 80401  
303-275-3000 • [www.nrel.gov](http://www.nrel.gov)

NREL is a national laboratory of the U.S. Department of Energy  
Office of Energy Efficiency and Renewable Energy  
Operated by the Alliance for Sustainable Energy, LLC

NREL/FS-5400-53619 • February 2012

Printed with a renewable-source ink on paper containing at least 50% wastepaper, including 10% post consumer waste.