Electric Cars Sell Power Back to the Grid

Delaware Test Fleet Makes Money by Serving as an Electricity Reserve

ENERGY

By MICHAEL FITZGERALD

In the 1990s, Willett Kempton, a professor at the University of Delaware, proposed in a paper that electric vehicles could help pay for themselves by selling power back to the grid. When no one jumped on the idea, he decided to develop the technology himself.

Now, the pilot project he spearheaded at the university in conjunction with power-plant operator NRG Energy Inc. [NRG +0.46% ▲] brings in roughly $110 a month per electric vehicle. The operation uses software to link a minimum of nine electric vehicles, mostly Mini Coopers, together into a virtual power plant on wheels that can both draw energy from the grid and discharge energy when needed.

"We're not earning enough money to get rich," says Dr. Kempton. But "it earns money, and it earns more money than it costs to do it."

The vehicles—which come with chargers that allow for a two-way flow of energy and have a custom-made circuit board added to control the connection with the other cars and grid—essentially are being used as a short-term ministorge facility by PJM Interconnection, the operator of the electricity-transmission system in much of the Eastern U.S.

When more electricity is produced than is required, PJM can discharge power to the car batteries for storage; when demand rises, it can draw the juice back out. The utility agrees to pay for the reserved capacity whether it uses it or not, and the controller in the vehicle ensures that the battery isn’t drained to the point that the car can’t be driven.

Scott Baker, a senior business-solutions analyst at PJM, says the grid operator sees electric vehicles as potential stabilizers for the system, help-
Balance of Power
The numbers behind the University of Delaware program using cars as a money-making reserve for the electric grid

<table>
<thead>
<tr>
<th>Cars used</th>
<th>23 (19 all-electric Mini E’s, 3 modified Scion xB’s, 1 experimental Honda Accord plug-in hybrid)</th>
</tr>
</thead>
<tbody>
<tr>
<td>What they do</td>
<td>Store or discharge electricity according to grid needs</td>
</tr>
<tr>
<td>Special equipment needed</td>
<td>Control board, $200-$300 per car</td>
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<tr>
<td>Power of car batteries</td>
<td>12 kilowatts per vehicle*</td>
</tr>
<tr>
<td>Minimum capacity needed for a grid “bank”</td>
<td>100 kilowatts/9 cars</td>
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<tr>
<td>Time connected to grid</td>
<td>24/7 except when being driven</td>
</tr>
<tr>
<td>Average daily driving time</td>
<td>About an hour per car</td>
</tr>
<tr>
<td>Monthly revenue per car from grid operator</td>
<td>About $150</td>
</tr>
<tr>
<td>Monthly electricity cost/car</td>
<td>About $40</td>
</tr>
<tr>
<td>Monthly profit</td>
<td>About $110 per car/$2,500 total</td>
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</tbody>
</table>

“For Minis and Scions. Honda power not disclosed.
Source: University of Delaware

The Wall Street Journal

auto makers were to design them into new EVs. Another issue is that the control boards are not commercially available, though Dr. Kempton says there have been promising discussions with two big auto makers and an auto-parts manufacturer.

Auto makers, meanwhile, don’t know yet whether frequent charging will shorten a vehicle’s battery life.

And laws and regulations have to change before cars can be used as power sources. Although the Federal Energy Regulatory Commission has passed rules that allow for alternative storage technologies, other regulatory bodies have been slower to do the same.

Dr. Kempton worked with Delaware’s utility commission to create the needed regulations, and the state legislature passed a law allowing vehicles to sell power back to the grid.

Still, the success of the Delaware project has inspired other research, says Scott Fisher, the director of alternative-energy services at NRG, which has licensed the vehicle-to-grid technology used in Delaware. NRG says it now plans to test whether electric vehi-
icles could power a building and will apply for funds from a 
$6 million pool of EV-to-grid research money available from 
California’s Energy Commission.

"I’m not saying it’s a 100% 
slam dunk," Mr. Fisher says. 
"But it’s important enough to 
warrant the time and energy 
and expense."

The U.S. military, meanwhile, 
has a $30 million project in the 
works to test vehicle-to-grid 
technology on five bases, in- 
cluding Los Angeles Air Force 
Base, starting this fall.

*Mr. Fitzgerald is a writer in 
Cambridge, Mass. Email him 
at reports@wsj.com.*