Controlled Power Technologies’ LC SuperHybrid demonstrator shows that it is possible to achieve the fuel economy of a full hybrid, but for a quarter of the additional cost.

Hybrid vehicles are attractive from a fuel efficiency perspective, with fuel/CO2 savings of 15%-20% compared to comparable conventional drivetrains. Toyota has led the market in the development of hybrid vehicles, with sales of approximately 3 million cars over the last 15 years. This sounds impressive, but when hybrid sales are considered in the context of the whole market their impact is insignificant, with less than 1% of total car sales.

The key reason is that this advanced technology is not cheap, adding €3,000 - €5,000 to the manufacturing cost of a mid-sized vehicle, and considerably more for a premium vehicle. By comparison, a mid-sized gasoline engine costs approximately €1,000 to manufacture. The significant on-cost of the hybrid drivetrain means that car manufacturers need to charge premium prices in order to recoup their costs.

From a customer perspective, hybrids perform well in urban and inter-urban drive-cycles, but typically cannot match the fuel efficiency of a modern diesel on a motorway. Combined with the high cost, this goes some way to explaining why hybrid sales have not taken off.

Controlled Power Technologies (CPT), which was spun out from Visteon in 2007, develops cost-effective CO2 reduction measures that do not require major redesign of the powertrain or vehicle electrical system. CPT’s core competencies include low voltage (12-48V) power electronics, advanced control software and the application of low voltage electrical machines to vehicle powertrains.

The LC SuperHybrid vehicle is an example of what can be achieved through such technologies. It is based on a VW Passat 1.4TSI, a mid-sized car powered by a relatively small gasoline engine, with the following technologies added:

- CPT’s SpeedStart – an advanced starter generator;
- Valeo’s electric supercharger (originally developed by CPT and sold to Valeo in 2011);
- ALABC’s advanced lead acid battery; and
- An electronic controller to integrate the systems.

The result is a car that has the performance level of the more powerful 1.8TSI engine, but with a 25% reduction in fuel consumption. This cost-effective evolutionary technology seems to make a lot of sense, and it is anticipated this kind of advanced micro-mild hybrid technology will appear in mainstream production cars from 2015 onwards.

<table>
<thead>
<tr>
<th></th>
<th>Micro Hybrid</th>
<th>LC SuperHybrid</th>
<th>Mild Hybrid</th>
<th>Full Hybrid</th>
<th>Rechargeable Hybrid</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Examples of models</strong></td>
<td>Smart mdh, e-HDI</td>
<td>Honda Jazz, Insight</td>
<td>Toyota Prius, Auris</td>
<td>Vauxhall Ampera, Volvo V60</td>
<td></td>
</tr>
<tr>
<td><strong>Electrical power</strong></td>
<td>2-3kW</td>
<td>3-10kW</td>
<td>10-15kW</td>
<td>20-50kW</td>
<td>60-70kW</td>
</tr>
<tr>
<td><strong>Electrical assistance</strong></td>
<td>None</td>
<td>20-35kW*</td>
<td>&lt;15kW</td>
<td>&gt;15kW</td>
<td>&gt;60kW</td>
</tr>
<tr>
<td><strong>Electrical range</strong></td>
<td>0 km</td>
<td>0 km</td>
<td>0 km</td>
<td>Approx. 2 km</td>
<td>30-50 km</td>
</tr>
<tr>
<td><strong>Fuel saving (%)</strong></td>
<td>4-7</td>
<td>15.25</td>
<td>8-12</td>
<td>15-20</td>
<td>&gt;20</td>
</tr>
<tr>
<td><strong>Overall additional cost</strong></td>
<td>€150-€700</td>
<td>€750-€1000</td>
<td>€1600-€3000</td>
<td>€3000-€5000</td>
<td>€6000-€10000</td>
</tr>
<tr>
<td><strong>Cost per % saving</strong></td>
<td>€35-€100/%</td>
<td>€50-€60/%</td>
<td>€200-€250/%</td>
<td>€200-€250/%</td>
<td>€300-€500/%</td>
</tr>
</tbody>
</table>

*12-48V + starter generator + electric turbo + engine remapping + taller gearing + lead-carbon batteries
Source: L’Automobile
The current LC SuperHybrid is based on a 12 volt electrical system. However CPT and ALABC will have a 48 volt version running later in 2013 which will be able to provide torque assist to the engine for launch and acceleration, optimise fuelling during cruise conditions, and harvest kinetic energy during braking.

CPT’s technology has received plaudits from the UK Low Carbon Vehicle Partnership (LowCVP) and Frost & Sullivan, as well as Autocar and L’Automobile, two of the leading car magazines in Europe. Jonathan Murray, deputy director of the LowCVP, described the results achieved by CPT and ALABC in applying a number of technologies to deliver the practical and commercially viable low carbon LC SuperHybrid car as “truly impressive”.

Some of the production-ready technology developed by CPT has already been sold to the leading French tier 1 supplier Valeo, thereby becoming the first global automotive component manufacturer to offer its OEM customers a range of electric superchargers, which helps to facilitate radical engine downsizing.

CPT’s current stable of technologies includes:
- **SpeedStart**: a powerful water cooled starter/motor and generator, able to provide torque assist to an engine and harvest kinetic energy from braking.
- **Tigers**: an exhaust gas energy recovery system, incorporating a low speed turbine in the exhaust stream, engineered to minimise back pressure, which powers an efficient switched reluctance generator.
- **Cobra**: a water cooled electric supercharger for commercial vehicle and off highway applications. A modified version of Cobra can also act as a compressor for active diesel particulate filter systems.

CPT is backed by a number of prominent corporate investors specialising in energy and environment including Conduit Ventures, Entrepreneurs Fund, Low Carbon Innovation Fund, Mowinckel Management, National Technology Enterprises Company, Reformer Group, Target Ventures and Turquoise Capital.

Further information on CPT is available at [www.cpowert.com](http://www.cpowert.com).