HOT! NEXT-GENERATION ELECTRIC CARS COMING TO SHOWROOMS

RON COGAN'S

GREEN CAR JOURNAL

WINTER 2010/2011

2011 GREEN CAR OF THE YEAR®: CHEVROLET VOLT ELECTRIC CAR!

TOP 5 VISIONARY VEHICLES

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- HONDA FIT EV
- MITSUBISHI i
- TOYOTA RAV4 ELECTRIC
- VOLVO C30 DRIVe

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It has never been an easy road for those who strive to be different and change the dynamics of an industry built on petroleum, speed, and steel.

The auto industry is in motion in ways that are both surprising and historic. For two decades, I've focused on advanced technology and alternative fuel vehicles, documenting their progress, challenges, successes, and sometimes failures. It has never been an easy road for those who strive to be different and change the dynamics of an industry built on petroleum, speed, and steel.

Perhaps the most exciting part of my editorial journey has been observing visionaries at work. They come in all shapes and sizes – small companies and multinationals, solitary entrepreneurs and CEOs in expansive boardrooms chock full of department heads – all with a common purpose. Their job is to reinvent the world, or at least the part of it that transports us from one place to another with efficiency and style.

They are often men and women far ahead of their time, like the late Paul MacCready, who founded the MacCready Group and then AeroVironment. MacCready and his team were largely responsible for the championship GM Sunraycer solar electric car that won the 1987 Solar Challenge in Australia, and the GM Impact electric car prototype – precursor to the production GM EV1 – that debuted at the 2000 L.A. Auto Show.

MacCready's visionary work also included such lightweight aircraft as the Gossamer Condor and Gossamer Albatross, the former an award winner for the first sustained human powered flight, and the latter the winner of aviation's largest prize for the first human powered flight across the English Channel. The Condor is displayed alongside the Wright Brothers 1903 Flyer and Charles Lindbergh's Spirit of St. Louis at the Smithsonian Air and Space Museum in Washington, DC.

Clearly, brilliance, innovation, and vision in one field can translate to another. GM proved that in 1985 when it acquired Hughes Aircraft Company, one of the leading defense electronics and satellite communications companies in the world, ending up not only with expanded business interests but also the skill and vision of…literally… rocket scientists. There is no question that this scientific brainpower has benefited the General's research and development over the years.

Even with incredible vision, the process of transforming great ideas into reality can sometimes take decades…or never happen at all. There are times, though, when the sweet spot of opportunity and need meets the well-timed introduction of truly innovative products…and great things happen.

One high-profile example comes to mind…our 2009 Green Car Vision Award™ winner. It shouted 'vision' then as it does now. Today, that vision has morphed into reality as this Green Car Vision Award™ winner – the Chevrolet Volt – has come to market and earned the distinction as *Green Car Journal's* 2011 Green Car of the Year®.

In this issue, we highlight the Chevy Volt even as we announce a new crop of visionary vehicles at the top of our list. These five finalists for the 2011 Green Car Vision Award™ include the Ford Focus BEV, Honda Fit EV, Mitsubishi i, Toyota RAV4 Electric, and Volvo DRIVe EV. While visionary vehicles take many forms and champion various technologies, it happens that this year offers an exclusive focus on battery electric drive, a reflection of the direction within many automakers' advanced vehicle development programs.

Today's move toward electrification owes a lot to MacCready and the visionaries at GM who brought the GM Impact to the fore two decades ago, thus helping usher in the modern era of electric cars. They were visionaries, to a one.

Ron Cogan
Editor and Publisher

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These are the people who often worked 70-hour weeks and sacrificed time with their families to make this car real.

Green Car Journal's annual Green Car of the Year® award program continues to grow in prominence. When first conceived six years ago, the goal was to be true to the magazine's mission of reporting on the intersection where automobiles, energy, and the environment converge, while standing apart from other automotive award programs.

Much of what makes this award so special is the unique process of selecting the winner. After the *GCJ* staff qualifies and selects the five finalists, a panel of 11 jurors determines the winner. In addition to *GCJ* editors, a greater number of outside jurors have a say. This year, we were honored to have the leaders of the nation's top environmental organizations involved including the Sierra Club, Natural Resources Defense Council, Ocean Futures Society, and Global Green USA. For balance, we were also pleased to have noted auto enthusiast Jay Leno and automotive legend Carroll Shelby as jurors.

Green Car of the Year® has grown to become a cornerstone at the Los Angeles Auto Show. It has become quite a production filling the huge glass atrium in the L.A. Convention Center. Even the reveal of the car has become more elaborate. The winner is kept secret until the announcement is made, then the car is revealed. Early in the program, a draped cover was pulled to unveil the winner, while today the car is hidden on stage behind a tall curtain that walls it off on all four sides. When the announcement is made, a switch is thrown and the heavy curtain instantly drops in what is known in the stage industry as a 'Kabuki drop,' an impressive display. This is L.A., after all, and a little showbiz is expected.

This year, Los Angeles Mayor Antonio Villaraigosa was on stage along with other dignitaries to congratulate the winner. As you should know by now, the 2011 Chevrolet Volt was named 2011 Green Car of the Year®. General Motors Vice President of U.S. Marketing Joel Ewanick accepted the award on behalf of the entire Volt team. To prove the flexibility of its range extending technology, Ewanick drove a Volt from the Detroit-Hamtramck plant 2,394 miles to the L.A. Auto Show to accept the award.

Considering the relatively short lead-time the Volt team was given to make the Volt concept a production reality, the 2011 Volt is all that more impressive. In many ways, this was a complete rethinking of the automobile, which leads to major design and engineering challenges. With that in mind, GM officials asked publisher Ron Cogan and me to make a second award presentation, this time in Detroit to the entire Volt team. These are the people who often worked 70-hour weeks and sacrificed time with their families to make this car real.

Mickey Bly, GM's Executive Director of Global Electrical Systems, Hybrids, Electric Vehicles, and Batteries, greeted us in Detroit and provided a production Volt to drive during our stay. The presentation was fittingly made inside one of the huge engineering garages on GM's Milford Proving Grounds where much of the engineering on the Volt took place. I've been to hundreds of press conferences and award presentations during my 30+ year career as an automotive journalist, and this one was very special. It was humbling to meet and recognize the dedicated and very talented people who made our 2011 Green Car of the Year® winner a reality. – *Todd Kaho*

BIG TRUCKS TO GET FUEL ECONOMY STANDARDS?

For years there have been fuel economy and greenhouse gas (GHG) emissions standards for cars and light trucks, but not for heavy-duty trucks and buses. Now, the Environmental Protection Agency and National Highway Transportation Safety Administration are proposing the first national fuel economy and GHG standards for these vehicles, the second-largest users of oil and contributors to CO2 emissions in the transportation sector.

Developed jointly, the EPA standards cover emissions, while the NHTSA standards are aimed at improving fuel economy. The proposed standards will apply to model years 2014-2018 combination tractors, heavy-duty pickup trucks and vans, vocational vehicles including buses, plus refuse and utility trucks. 'Heavy-duty' means on-road vehicles with a gross vehicle weight of 8,500 pounds or greater. EPA proposed standards includes recreational vehicles such as motor homes, while the NHTSA fuel economy standards do not.

The standards are quite complex because moving heavier loads requires more fuel and results in greater emissions of CO2 than moving lighter loads. They also apply to a wide range of vehicles: Light Heavy (Class 2b through 5); Medium Heavy (Class 6 and 7); and Heavy Heavy (Class 8). Finally, there are different standards for nine subcategories of combination tractors based on weight class, cab type, and roof height. Each manufacturer's standard for a model year would depend on its sales mix, with higher capacity (payload and towing) vehicles having numerically less stringent target levels. There is an adjustment for four-wheel drive vehicles.

EPA is also proposing standards for HFC emissions from air conditioning systems in pickups, vans, and tractors.

EPA is also proposing standards for HFC emissions from air conditioning systems in pickups, vans, and tractors. Air conditioning contributes to GHG emissions directly through refrigerant leakage with indirect emissions resulting from the additional engine power needed to handle the A/C load.

ANALYSIS

When fully implemented in 2018, the estimated per-vehicle reduction in GHG emissions should be 17% for diesel vehicles and 12% for gasoline vehicles. The proposed NHTSA standards represent an average per-vehicle improvement in fuel consumption of 15% for diesel vehicles and 10% for gasoline vehicles, compared to 2010 vehicles.

The two agencies project these standards will reduce GHG emissions by about 250 million metric tons and save 500 million barrels of oil in the first five years, translating into $41 billion in net benefits over the lifetime of 2014 to 2018 vehicles. An operator of a semi truck could pay for the technology upgrades in less than a year, and save as much as $74,000 over the truck's useful life. The payback for trucks that travel fewer miles annually could take four or five years, but there would still be cost-savings. – *Bill Siuru*

Bill Siuru is a retired USAF colonel who has been writing about automotive technology for nearly 40 years. He has a Bachelor degree in automotive engineering, a PhD in mechanical engineering, and has taught engineering at West Point and the U.S. Air Force Academy.

Crazy-Fast Electric Supercar

The list of high-performance, expensive all-electric sports cars keeps growing. The latest is the INIZIO from Li-ion Motors, located in North Carolina. The company recently won a Progressive Automotive X PRIZE in the Side-by-Side Alternative Class with its Wave II electric vehicle.

The INIZIO is powered by Li-ion Motors' lithium-ion batteries that supply over 40 kilowatts of on-board energy, with an upgrade to 96.7 kilowatts available. With the optional extreme performance motor package, the electric motor can deliver up to 207 horsepower and enable the supercar to accelerate from 0 to 60 mph in 3.4 seconds. Top speed is an impressive 170 mph. Also impressive is a range of up to 250 miles, with a full charge that takes as little as 8 hours using a standard 220 volt outlet.

A movable back wing provides optimum down force while a ridge embedded in the body redirects airflow to reduce wind noise and drag. The sleek exterior features smooth and rounded edges, high-intensity

The electric motor can deliver up to 207 horsepower and enable the supercar to accelerate from 0 to 60 mph in 3.4 seconds.

halogen headlights, and a removable hard top. Access is via scissor-style doors that rotate 90 degrees. Driver and passengers are treated to power adjustable leather and suede Recaro seats with both heating and cooling. Side and rear view mirrors are coupled with high-definition cameras to provide a 360 degree view surrounding the car. Li-Ion says the custom-built INIZIO will be available in mid-2011 with a price starting at $139,000. It is now taking orders. —*Bill Siuru*

[It's been said...]

"More than 10 years ago, Fiat introduced the 'Natural Power' line, through which it established a leadership position in vehicles powered by CNG – compressed natural gas. Today, natural gas is a rational alternative to gasoline that can provide a near-term environmental solution on the road to vehicle electrification. CNG is an eco-friendly fuel with up to 25 percent fewer CO2 emissions compared with gasoline. And it is economical for customers with a price advantage of about 25 percent versus gasoline."

— Sergio Marchionne, CEO
Fiat-Chrysler Group

H2Aloha

Hawaii's interest in alternative fuels has taken form in recent years with the use of biofuels, hydrogen, and electric vehicles in various civilian and military demonstration programs. Now, the U.S. Navy is among the first to take delivery of a GM fuel cell vehicle as part of the Hawaii Hydrogen Initiative, which is striving to make hydrogen vehicles a reality on the islands. The Initiative plans up to 25 strategically placed hydrogen stations around Oahu by 2015. A growing number of hydrogen vehicles has been undergoing testing at Hickam Air Force Base on Oahu as part of a program with the state's High Technology Development Corporation, with the first hydrogen fueling station established at Hickam in 2006. —*Ron Cogan*

Wheego LiFe Electric

Wheego Electric Cars says it will soon begin delivering its fully highway-capable, two-seat Whip LiFe EV. The LiFe designation comes from the Li and FE chemical symbols for iron, alluding to its lithium iron phosphate battery pack. The company's existing Whip neighborhood electric vehicle uses lower-tech AGM lead-acid batteries. Both the LiFe and low-speed Whip share the same body, with the primary difference being the drivetrain and the LiFe's U.S. crashworthiness certification (low-speed NEVs don't require this). The chassis and unibody for these vehicles comes from Chinese auto manufacturer Shuanghuan Automobile Co.

The $32,995 Whip LiFe can travel about 100 miles on fully a charged 30 kilowatt-hour battery pack. Top speed is 70 mph. Driven by a 20 horsepower AC electric motor, the $19,000 Whip low speed vehicle has a 50 mile range and either a 25 mph or 35 mpg top speed, depending on the intended market. Both qualify for a federal tax rebate. The company has 22 dealers nationwide with all but two traditional car dealers selling products like Subaru, Ford, and Chrysler models. —*BS*

Overstock Green

Those who like to shop bargains may well be familiar with Overstock.com, an online retailer offering brand-name merchandise at discount prices. Its usual fare is pretty wide-ranging, with customers able to shop everything from furniture, housewares, and garden accessories to clothing, jewelry, and electronics. Now, as part of the new website design for its Cars section at www.cars.overstock.com, buyers interested in 'green' cars have a new way to connect with available models.

Viewers can search by make and model, year, location, and price to find the best values. The 'Be Green' section displays a nationwide list of all hybrid, biodiesel, electric, natural gas, ethanol, and plug-in cars advertised on the site. Overstock.com also offers its TrueCar Price Report, which shows recent sales data in a buyer's area and what others paid for the same car. A free TrueCar Price Report is claimed to reveal what car prices are great, good, or overpriced to aid an informed purchase. —*RC*

L.A. Auto Show, Electrified

Without question, the L.A. Auto Show is the place to see the latest vehicles that address environmental performance. Chalk it up to this show's location in car-centric Southern California, where automotive trends often originate, or this region's historic battle with air quality. Whatever. Just know that automakers understand this and often roll out their most interesting and leading-edge eco-concepts and production vehicles here.

And so it was with the 2010 L.A. Auto Show, where an array of high-profile vehicles were shown including the Honda Fit EV Concept, Chevrolet Volt, Infiniti M35 Hybrid, Nissan Leaf, Kia Optima Hybrid, Mitsubishi i, Toyota RAV4 EV, and others.

More than 20 high-tech vehicles were available for media to drive at the Green Cars L.A. Auto Show Ride-and-Drive including electric, hybrid, and advanced gasoline and diesel models. Audi also fielded an A3 TDI running on clean-burning RenDiesel from Rentech, a synthetic fuel made from sources as diverse as natural gas and green waste. To cap it off, *Green Car Journal* also presented its 2011 Green Car of the Year® award to Chevrolet for its Volt extended range electric car, covered elsewhere in this issue. – *Green Car Journal Editors*

GREEN CAR VISION™ AWARD

5 Cars that Envision the Road Ahead

Winner to be Unveiled at Washington Auto Show

BY GREEN CAR JOURNAL EDITORS

Milestone vehicles we're seeing come to market today are the result of years of research, development, and planning, with much of this occurring in an environment where assumptions must be made about future markets and sales. There is risk involved…and no small investment. These vehicles borne of vision and a healthy dose of innovation are, literally, our future.

As we head toward this 'greener' transportation future, it's important to recognize the achievements being made by those who have stepped up to lead. *Green Car Journal's* Green Car Vision Award™, presented each year at the Washington Auto Show, is the industry's acknowledgement of this leadership.

This award complements the magazine's Green Car of the Year® program, which focuses on production vehicles that raise the bar in environmental performance and are available to consumers today. The Green Car Vision Award™ aims at the road ahead, acknowledging a visionary vehicle that's in a demonstration program or in its early stages of commercialization, but not yet on sale.

Today, electric drive represents the technology of choice for many future vehicle programs, a fact that will surely be evident at the 2011 Washington Auto Show. Here, one of five battery electric contenders – from Ford, Honda, Mitsubishi, Toyota, and Volvo – will be named *Green Car Journal's* 2011 Green Car Vision Award™ winner during the show's second Policy Day on January 27.

2011 GREEN CAR VISION AWARD FINALISTS

FORD FOCUS BEV

Ford's Focus BEV, based on the automaker's all-new 2012 Focus, will be introduced in the U.S. sometime in 2011. The automaker is leveraging global platforms like the Focus and collaborating with key powertrain suppliers as part of its global electrification strategy.

HONDA FIT EV

The Honda Fit EV concept shares the direction and styling of the upcoming production Fit EV that will be coming to U.S. shores in 2012. The five-passenger electric will be powered by lithium-ion batteries and feature Econ, Normal, and Sport modes.

MITSUBISHI i

Mitsubishi will produce the newly-named Mitsubishi i electric vehicle, a lithium-ion battery powered iteration of the automaker's popular 'i' minicar sold in Japan. It will be sold in four Western states starting in November 2011 with a national roll-out to follow.

TOYOTA RAV4 EV

Toyota's RAV4 EV will begin a demonstration program in 2011 with plans for market arrival of a fully-engineered vehicle in 2012. The automaker has partnered with Tesla to fast-track development, with Tesla providing the lithium metal oxide battery and related components.

VOLVO DRIVE ELECTRIC

The Volvo C30 DRIVe is an electric variant of this automaker's sport hatchback powered by lithium-ion batteries. A small test fleet is operating in Sweden with a larger demonstration of DRIVe electrics planned for Europe, China, and the U.S. in 2011.


:: FORD FOCUS BEV

:: HONDA FIT EV


:: MITSUBISHI i


:: TOYOTA RAV4 EV

:: VOLVO DRIVe ELECTRIC

PEUGEOT SR1

Smooth 2+1 Grand Touring Car Uses Hybrid4 Power

BY BILL SIURU

PSA Peugeot Citroen has developed its Hybrid4, previously called HYmotion4, which is planned for initial use in the Peugeot 3008 crossover to appear in 2011. As an example of the versatility of this parallel hybrid architecture, Peugeot has presented the striking Peugeot SR1 grand touring car. The SR1 is a 2+1 coupe with a third passenger seat located between two front seats. Entry to this seat is facilitated by the center console that slides forward for better access.

The Hybrid4 features an internal combustion engine driving the front wheels and an electric motor driving the rear wheels, with no mechanical connection between the two. The SR1 concept uses a 1.6 liter THP (Turbo High Pressure) gasoline engine, a turbocharged four-cylinder engine developed in conjunction with BMW.

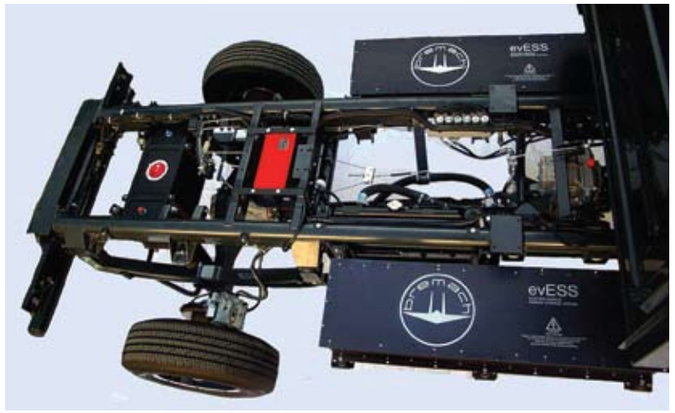
The SR1 engine produces 218 horsepower. When combined with the rear mounted 95 horsepower electric motor, a total of 313 horsepower is available for peak performance. Details of the Peugeot 3008 have yet to be revealed. However, shown in Prologue HYmotion4 form, it used a 163 hp, 2.0 liter four-cylinder turbodiesel and a 36 hp electric motor.

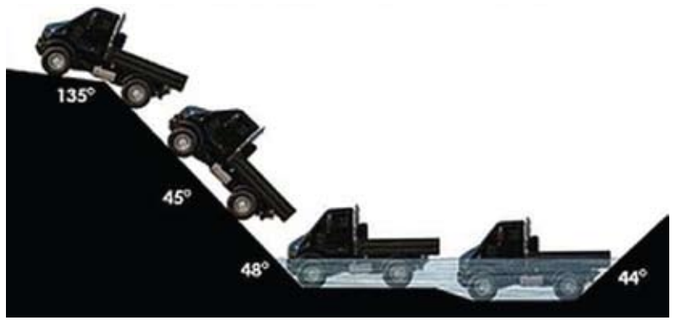
Besides four-wheel-drive, the Hybrid4 allows an electric-only mode at lower speeds to make it a zero emission vehicle. When both engine and motor are used it features a combined fuel consumption of 48 mpg. The SR1 also has four-wheel steering with steering angle controlled as a function of road speed. This combination of performance, driver-selectable power, and sensuous styling would certainly be a hit with buyers if a production model inspired by the SR1 makes its way to the showroom. We're crossing our fingers on that one.

BREMACH T-REX

An Extreme 4x4 Offering Electric and Alternative Fuel Options

BY **BILL SIURU**





Bremach, which has been building specialty trucks in Italy since the mid-1950s and marketing them in Europe, Africa, and Latin America, is entering the U.S. market. Bremach USA has established its headquarters in Chino, California and plans to build and market the Bremach T-REX extreme-duty 4x4 in the U.S. This class-3 truck, which offers a 3 ¾ ton payload capacity, will be offered with a variety of powertrain options – BEV (battery electric vehicle), series hybrid electric, gasoline, CNG, and in the near future, LPG.

Both the BEV and hybrid T-REX use Bremach's Hybrid-VLV (Very Low Voltage) brushless, permanent DC motor/generator. Compared to the typical BEVs and HEVs that operate at 250 to 400 volts or higher, Bremach has developed technology that allows this much lower voltage without compromises in efficiency or performance. The compact, 9.5-inch diameter VLV motor/generator operates at 114 volts DC, like the voltage found in American homes. It's rated at 200 kilowatt peak and 150 kilowatt continuous output with 360 Newton-meter peak torque.

The all-electric version features a 100 kilowatt-hour battery pack, while the plug-in hybrid variant uses a 40 kilowatt-hour pack. The Li-ion battery packs are built with large-format prismatic cells. The BEV T-REX is designed to travel some 200 miles on a single charge. Bremach says this translates into a practical range of between 75 to 100 miles in real world use..

The series-hybrid T-REX uses a VLV motor as a generator combined with a 2.0-liter gasoline engine. This series hybrid is good for some 30 and 60 miles of all electric travel before the VLV, used as a starter, engages the engine and then serves as a generator to recharge the batteries while driven. The VLV is also used as a generator for regenerative braking on both the BEV and hybrid versions. The internal combustion T-REX uses a GM 6.0 liter V-8 engine rated at 323 horsepower with 373 lb-ft torque. It's mated to a GM four-speed 4L85E automatic heavy-duty transmission.

Bremach has developed technology that allows this much lower voltage without compromises in efficiency or performance.

The T-REX uses a unique tubular structure inspired by aerospace technology. The all-steel roof, hood, and sides do not have any structural function, like in a fighter cockpit. Designed for serious off-road duty, the cab's reinforced floor can withstand up to 5 Gs vertically, compared to most of its competition that provides 2 Gs of vertical shock and, for extreme duty, maybe 3 Gs.

Military-grade suspension is used with rigid axles and parabolic leaf springs, telescopic double-acting shock absorbers, and properly dimensioned front and rear stabilizing bars. The T-REX has a low overall center of gravity for excellent stability in rugged terrain, while offering a high ground clearance of 11 inches that is complemented by large approach, departure, and breakover angles. The Bremach T-REX is a relatively small vehicle that can carry almost four tons under extreme road conditions. While only 1.9 meters wide, the T-REX cab can seat three in comfort.

Being completely hand built, customers can specify bodies and cabs, including crew and open cabs, to meet their needs. Various wheelbases are offered.

CHEVROLET VOLT WINS TOP HONORS

BY GREEN CAR JOURNAL EDITORS

General Motors' milestone electric car, the Chevrolet Volt, has been honored with *Green Car Journal's* 2011 Green Car of the Year® award by a jury of environmental and automotive leaders. Announced at the Los Angeles Auto Show, the Volt emerged on top of an impressive list of finalists that included the Ford Fiesta, Hyundai Sonata Hybrid, Lincoln MKZ Hybrid, and Nissan LEAF.

This honor is well deserved. The Chevy Volt is without peer, an example of what advanced technology, intelligently applied, can accomplish without imposing compromise. That's an important distinction. There's significant interest in vehicles with improved environmental performance these days, but too often the opportunity is lost if drivers are required to sacrifice convenience, functionality, or any of the attributes that drive buying decisions at the showroom. The Chevy Volt requires no such concessions.

The Volt is an all-new type of electric car that offers extended range with electricity created by its on-board internal combustion generator. The Volt's revolutionary Voltec propulsion system is capable of delivering 25 to 50 miles of all-electric driving on a single charge before a gasoline-powered on-board generator provides electricity to power the wheels for an additional 300 miles.

Among this year's Green Car of the Year® jurors were Carl Pope, chairman of the Sierra Club; Frances Beinecke, president of the Natural Resources Defense Council; Jean-Michel Cousteau, president of Ocean Futures Society, and Matt Petersen, president of Global Green USA. Also, noted auto enthusiast and 'Tonight Show' host Jay Leno as well as auto icon Carroll Shelby were on the jury, along with *Green Car Journal* editors.

This award welcomes a new genre of mass-production electric vehicles to the consumer market, with the Volt as the first-ever electric vehicle to take top prize. The Chevy Volt is a breakthrough car deserving of the title 2011 Green Car of the Year®.

The Chevy Volt is a breakthrough car deserving of the title 2011 Green Car of the Year®.

HYUNDAI ELANTRA

A New Day Dawns for 40 MPG Sedans

BY **TODD KAHO**

HYUNDAI ELANTRA

Hyundai is certainly on top of its game with the all-new Elantra. This sedan is stylish, comfortable, fun to drive, and gets 40 mpg…at a price starting at just $14,830.

The all-new 2011 Hyundai Elantra sets a new fuel economy benchmark in the compact car segment. Every new Elantra that drives off a Hyundai dealer's lot will deliver a highway fuel economy rating of 40 miles per gallon. That's true for both manual and automatic transmission models. There are other compact cars that offer 40 mpg on the highway, but as Hyundai is quick to point out, you must order a special model to obtain that high mileage.

Fortunately, great gas mileage is just one of the many things to like about the new fifth generation Elantra. Think of it as 'Sonata Lite.' The new Elantra is light years ahead of this automaker's earlier generation cars in every respect. From the first time you climb behind the wheel, Elantra hardly feels like a compact car. It simply has a larger on-road presence. For 2011, Elantra grows an inch in overall length and two inches in wheelbase. That stretched wheelbase combines with great suspension tuning to add up to a very pleasing car to drive.

The Elantra's powertrain is all-new as well. Replacing the Beta 2.0-liter four-cylinder is a Nu 1.8-liter Dual CVVT engine. Though Hyundai didn't fit the engine with direct injection like the Theta II engine in the Sonata, it was engineered to accept the technology in the future. Still, the new engine delivers 7 percent more horsepower and is 74 pounds lighter than its predecessor. Hyundai rates power output at 148 horsepower at 6,500 rpm and 131 lb-ft of torque at 4,700 rpm.

During our test drive on canyon roads, mountain passes, and stretches of interstate in Southern California, the new Elantra consistently delivered peppy performance. Both the six-speed manual and six-speed automatic are fun to drive. The automatic offers Shiftronic manual shift mode for those times when a bit more control over gearing is desired. What does 40 mpg get you? In the case of the Elantra you can cruise more than 500 miles on the highway between fill-ups. Best of all, a manual shift Elantra GLS starts at just $14,830…quite the deal.

CAR2GO

Successful Car Sharing Program Expands to Berlin

BY **BILL SIURU**

Daimler's car2go GmbH launched its car sharing program in Ulm, Germany in 2009, followed by a similar program in Austin, Texas in May 2010. Based on the success of these two pilot programs, car2go is expanding to Hamburg, Germany as the first city in a planned international market launch.

In Ulm, 20,000 customers currently use the 200 diesel-powered smart fortwo cdi cars on an as-needed basis, while the car sharing service in Austin has achieved 10,000 registered members with over 80,000 rentals in its first four months. Hamburg-based Europcar Autovermietung and car2go have established car2go Hamburg GmbH that will begin service in spring 2011, operating 300 smart fortwos with the potential for more if there's sufficient demand.

One reason for car2go's popularity is its very flexible business model. Unlike most station-based car sharing projects, car2go customers can spontaneously rent cars without prior reservations, then use them for as long as they want without committing to a specific return time. The cars can be found at many locations and rented immediately throughout the entire car2go operating area.

Car2go customers can spontaneously rent cars without prior reservations, then use them for as long as they want without committing to a specific return time.

One-way trips are very popular. In Ulm, nine out of 10 rentals end at a different location from where they started. At the end of a rental, the vehicles can be parked in any public parking space that offers unlimited parking within the car2go business area or parked in city-managed car parks and parking spaces. By-the-minute rates are available that include fuel, insurance, parking, and maintenance. There is an initial membership fee.

The smart car2go cars used in Hamburg will be the first series-produced versions built specifically for car sharing. All are equipped with a fuel efficient gasoline engine, automatic start/stop system, newly developed telematics, and a solar roof.

The telematics include a new central control panel with a large 6.5-inch touch screen. The panel also houses the vehicle key and up to four chip cards for refueling and entering multi-story car garages. The telematics unit is networked with the vehicle's electronics system and can control features including its immobilizer system.

The output of the 100 watt solar roof can power the telematics and continually charge the battery. This relieves load on the alternator, thus reducing fuel consumption. Solar energy can also help power the climate control system so interior temperatures are comfortable before occupants enter. This also helps reduce fuel usage and greenhouse gases since the engine has to supply considerably less energy to cool down a hot interior at the beginning of any drive.

Europcar, the European leader in car and light utility vehicle rentals, has a 75 percent stake in car2go GmbH, which brings Europcar's vast expertise in fleet management and logistics to bear, as well as an extensive network of branches available to car2go users that complement its car rental services. Together, car2go and Europcar offer the perfect mobility service for large, modern cities: spontaneous car2go mobility for short trips combined with the extensive Europcar vehicle fleet, ranging from compact cars to trucks for longer routes and rental periods. Additionally, car2go offers an ideal platform for new propulsion technology like electric drive.

VOICES :: *By John Bacon*

A SAFE BET FOR ENERGY DIVERSITY

At this writing, gasoline prices are creeping upwards and analysts are – again – predicting that $5.00 per gallon prices are 'just around the corner.' Somehow these same analysts seem surprised at their own news, yet this country has been dependent on foreign energy sources for decades.

BAF, A Clean Energy company, has been converting vehicles to run on natural gas since 1992 and has upfitted more than 12,000 vehicles to run on this plentiful, domestic alternative fuel. Admittedly, it has been an uphill battle to make real progress and bring these natural gas-powered vehicles from fleet service to the driveways of millions of Americans.

The good news is that the forces necessary to make this dream come to fruition are beginning to align. Because consumers are becoming more educated, they are demanding more from their politicians and vehicle manufacturers in order to improve the environment, keep fuel prices low, reduce our dependence on foreign oil, and keep America safe. It is a tall order to achieve these results and yet it is possible with natural gas.

As our country's leaders consider federal, state, and local legislation to motivate the adoption of alternative fuels into the marketplace, it is always important to remember to keep one thing at the forefront: safety.

It's a massive undertaking to put a safe vehicle on the road and it should never be taken lightly.

BAF and Clean Energy have always pursued the highest safety certifications, investing heavily in the testing required to ensure that the technology powering the family car meets or exceeds the toughest standards.

But consumer demand and political pressure can sometimes have unintended consequences. Only 16 states have adopted – to varying degrees – the strict standards set forth by the California Air Resources Board (CARB). Still others do not require approvals from the Environmental Protection Agency (EPA), a less strict but still critical set of requirements.

The argument, of course, is that easier entry into the market will encourage new natural gas vehicle providers to emerge and supply the increasing demand to fleets and consumers. Yet, what some legislation will do instead is allow less safe vehicles onto our shared roads.

Cutting corners on safety is simply not acceptable. Think about what OEMs must go through to get a car on the road today. Consider the engineering, certifications, crash testing, and other investments automobile manufacturers make to ensure our safety in case of an accident. Now think of the service infrastructure required to maintain those vehicles. This does not even include states with annual inspection requirements.

It's a massive undertaking to put a safe vehicle on the road and it should never be taken lightly. That's why BAF supports maintaining and enforcing strict standards, to include CARB as well as crash testing for alternative fuel vehicles.

Yes, this testing and certification is expensive, and frankly that's a good thing. Today only a few companies, including BAF, have made the necessary investment to ensure that upfitted compressed natural gas vehicles are as safe, or safer, than those powered with gasoline.

However, the onset of 'kits' into the marketplace that are installed by neighborhood mechanics threatens the future of the entire industry. Just one accident from an inferior system could paralyze the progress of not just the natural gas vehicle industry, but of those goals mentioned earlier: improving the environment, keeping fuel prices low, reducing our dependence on foreign oil, and keeping America safe. Just one neighborhood mechanic with a non-certified kit could put our progress in jeopardy.

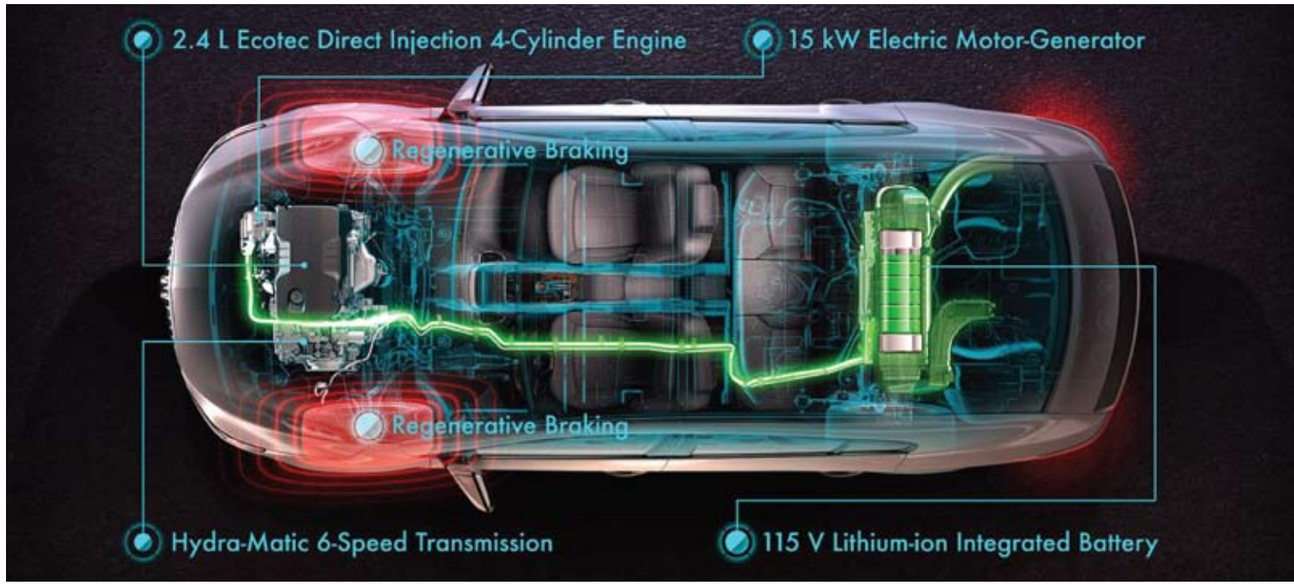
BAF and Clean Energy remain committed not only to advancing the welfare of the natural gas industry as a whole, but to supporting and advancing the goals of our country. Again, it's a tall order, but we believe it is possible and natural gas can help lead the way.

— John Bacon is President of BAF Technologies, a leading provider of natural gas vehicle systems and conversions for taxis, limousines, vans, pick-up trucks, and shuttle buses.

GM eAssist

Buick LaCrosse gets mild hybrid tech

BY **BILL SIURU**



Based on GM's Belt Alternator Starter (BAS) system offered on the 2007-2009 Saturn Aura and Vue, plus the 2008-2010 Chevrolet Malibu Hybrid, the General's latest generation eAssist system supplies over three times greater power than the previous iteration. This mild hybrid eAssist technology provides regenerative braking and stop/start functions to deliver a welcome bump in fuel efficiency.

All 2012 Buick LaCrosse luxury sport sedans equipped with four-cylinder engines will come with eAssist as standard equipment. Combined with several other features, there's a 25 percent increase in fuel economy compared to the 2011 LaCrosse equipped with the same 2.4 liter engine.

The liquid-cooled, 21.5 horsepower motor-generator replaces the alternator on the 2.4-liter Ecotec four-cylinder engine, providing both motor assist and battery charging via a new belt-drive system. The DOHC direct injection engine is rated at 182 horsepower and 172 lb-ft torque and is coupled to a modified Hydra-Matic 6T40 6-speed automatic transaxle.

Electrical energy is stored in a 115 volt, 0.5 kilowatt-hour lithium-ion battery. This battery, an integrated power inverter, and a conventional 12 volt battery are located between the rear seat and trunk. While the car's trunk capacity is reduced slightly there is still access to the trunk via a split-folding rear seat. An electric fan cools the power pack, drawing air from a vent located in the rear package tray.

During regenerative braking, up to 15 kilowatts of electricity is available to charge the battery. Some 15 horsepower of electric assist is available for heavy acceleration. This added power allows taller gearing to improve fuel economy without degrading acceleration performance or driveability. By providing some electric assistance at cruising speeds, light acceleration or mild grade climbing can be done without the transmission downshifting.

Other fuel saving technologies in the eAssist equipped LaCrosse include engine shut-off when stopped and fuel cut-off during deceleration. Improved aerodynamics include better underbody airflow, active control of front-end airflow, and electronically controlled shutters in the lower grille that close at higher speeds to push more air over the vehicle, thus increasing aerodynamic efficiency. Tires are optimized for performance and fuel economy. An ECO gauge helps a driver achieve maximum efficiency. The full-size eAssist LaCrosse luxury sedan will offer 37 mpg highway and 25 mpg city economy for about $30,000.

VW GOLF BLUE-E-MOTION

Electrics Coming to the Volkswagen Line

BY **TODD KAHO**

VOLKSWAGEN HAS PLANS to launch an electric vehicle as early as 2013. The Golf blue-e-motion will likely be based on the upcoming seventh generation Golf hatchback. This move will allow drivers to experience pure electric power in the most successful car model in Europe. The developmental car you see here is the current Golf fitted with an all-electric powertrain.

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VW GOLF BLUE-E-MOTION

Battery modules are located beneath the rear floor, rear seat, and between the front seats.

VW's Golf blue-e-motion concept is quite far along in the developmental process, no surprise since Volkswagen is no newcomer to electric drive. This automaker's exploration with electrics dates back to an electrified Transporter in 1973. The first 25 horsepower electric Golf emerged in 1976. Volkswagen has continued electric drive development with cars like the CityStromer in 1981 and the Space Up! concept as recently as 2007.

The Golf blue-e-motion concept is powered by a 115 horsepower electric motor driving the front wheels. While that doesn't sound like a lot, the motor's 199 lb-ft torque makes it feel quite peppy. For comparison, the 2.5-liter five-cylinder gasoline engine in the standard Golf produces 170 horsepower at 5,700 rpm and 177 lb-ft of torque at 4,250 rpm. Electric motors produce maximum torque immediately, so the power delivery provides great acceleration from a stop.

The Golf blue-e-motion stores electrical energy in 180 lithium-ion battery cells bundled into 30 modules. These modules are located primarily beneath the rear hatch floor and rear seat, with four of the modules secreted in the area between the front seats. This configuration has a total capacity of 26.5 kilowatt hours of electricity. The batteries have a dedicated air-cooling system to maintain maximum performance.

Electric motors produce maximum torque immediately, so the power delivery provides great acceleration from a stop.

The all-important question with all pure electric vehicles is how far a car can travel on a charge. In this case the Golf blue-e-motion's range is reported at 93 miles, or 150 kilometers. That's close to the Nissan Leaf's claimed 100 mile range and the projected range for the Ford Focus BEV. That's with today's battery chemistry. As development continues, Volkswagen may find even greater range.

Volkswagen utilizes a 'sail' feature that disengages and shuts down the electric motor when a driver lets off the accelerator, similar to the scheme used on the Touareg Hybrid. This minimizes mechanical drag so the Golf can coast more efficiently to optimize range. A control on the shifter allows a driver to manipulate how much free-flow coasting the car does verses regenerative braking, which uses the drive motor as a generator to slow the Golf blue-e-motion and recapture electrical energy.

There are selectable energy management profiles, too. If you have longer distances to cover, setting the car to maximum range mode is the way to go. In this mode, the blue-e-motion is configured for super-efficient operation to achieve the greatest driving range. You can also select a mode for maximum comfort and another for sporty driving dynamics, depending on your needs at the time. Changing modes reprograms electric motor power, climate control, top speed, and the car's battery regeneration strategy. When the time does come to recharge, the Golf blue-e-motion is plugged in to a receptacle located behind the normal gasoline fuel filler door.

URBAN LUXURY

Cadillac's Answer for City Driving

BY **BILL SIURU**

This stylish, pint-sized Cadillac hybrid is designed for efficient urban driving where a small footprint is desired.

Will future city cars offer just basic transportation? Cadillac doesn't think so, and thus has designed the Urban Luxury Concept that debuted at the recent Los Angeles Auto Show. The design focused on providing the luxurious accommodations and advanced in-vehicle infotainment technology expected in a Cadillac, but in a much smaller package for use in congested city environments where parking is a premium.

Rather than a pure electric vehicle, the Urban Luxury Concept is a hybrid with a turbocharged, 1.0 liter three-cylinder engine combined with an electric motor.

Rather than a pure electric vehicle, the Urban Luxury Concept is a hybrid with a turbocharged, 1.0 liter three-cylinder engine combined with an electric motor. This combination provides fuel saving features like electric assist, engine start-stop, and regenerative braking. This adds up to a projected fuel economy of 56 mpg in the city and 65 mpg on the highway.

According to Cadillac, the Urban Luxury Concept has a small exterior footprint but is roomy inside for four people. While it's only 151 inches long, it has a relatively long 97.1 inch wheelbase. This, plus riding on 19-inch wheels, results in almost no front or rear overhangs and provides maximum interior space. It is 68.1 inches wide and 56.9 inches tall.

The body styling is pretty unconventional but easily recognized as a Cadillac, courtesy of sharp edged styling cues that have characterized the brand in recent years. The large windshield and twin skylights provide an open and airy feeling that enhances the perception of interior spaciousness. At the touch of a button, the large, scissor-type doors extend outward and rotate forward. They are ideal for tight urban parking spaces, providing access for those in front and rear.

While urban drivers may not travel many miles, they can spend lots of time in their vehicles while negotiating congested city traffic. Thus, Cadillac designers devoted particular attention to interior accommodations. For example, the front seats slide and recline for a more relaxed seating position. When folded flat, the seat's rear panel includes a docking station for an integrated Orbit Baby SmartHub.

There is much advanced, interactive technology. Touch-pad screens and projected readouts replace most traditional gauges and controls for the audio and climate systems. The conventional 'center stack' is replaced by a divided interface that creates more space. Capacitive multi-touch switches ensure seamless and intuitive electronic control. Touch pad controls are ergonomically tucked around the steering wheel for real-time feedback. The front passenger has a separate touch pad that can be used for functions such as requesting destination directions or audio playlists.

As expected in a luxury Cadillac, high-end trim materials are used throughout the interior such as blue and grey leather on the seats, instrument panel and door panels. There are also carbon-colored wood inlays, brushed aluminum accents, and ceramic materials. Ambient lighting conveys an upscale aura.

HONDA FIT EV

Small Electric Offers Big Features

BY **RON COGAN**

Honda is one of those automakers that has always done more than its share to address environmental compatibility. When 'environmental positioning' was a popular more-talk-than-action strategy in the auto industry a few decades back, it was often Honda stepping up to do something real – like introducing near-zero emission gasoline vehicles, offering an assembly-line produced natural gas sedan, and of course being the first to the U.S. market with a gasoline-electric hybrid. This hasn't changed, although you wouldn't necessarily know it because of all the noise out there in eco-land.

At the L.A. Auto Show, Honda unveiled its vision for the Honda Electric Mobility Network that included the Fit EV Concept, an all-electric hatchback that provides a strong indication of what to expect in the upcoming all-electric Fit EV model. Destined for the U.S. and Japan in 2012, the Fit EV will be powered by lithium-ion batteries and an efficient coaxial electric motor derived from Honda's FCX fuel cell vehicle program.

The Fit EV will be designed to deliver a top speed of 90 mph and an estimated 100 mile driving range. That range can be optimized by driver input using a three-mode electric drive system adapted from the Honda CR-Z hybrid that allows choosing Econ, Normal, and Sport modes. Honda says that running in Econ mode can increase driving range up to 17 percent compared to driving in Normal mode. Selecting the Sport mode brings a significant acceleration boost that's said to provide performance similar to that of a 2.0-liter engine.

Other measures are built in to help make the most of on-board power. For example, a display advises when to shut down air conditioning and other accessories to maximize battery life. When the time does come to charge, Honda says a fully depleted Fit EV can be ready-to-go in less than 12 hours when charged from a conventional 120 volt outlet and less than six hours using a 240 volt charger. To make charging convenient, the Fit EV will come standard with a Honda Satellite Linked Navigation System that includes a charging station locator function.

Electronics looms large in the Fit EV. It will come with smartphone and computer connectivity for remotely viewing state-of-charge, initiating a charge, and pre-conditioning the interior by activating air conditioning while plugged in. A pocket-sized Honda interactive remote will also provides connectivity without requiring a cellphone signal or internet connection.

VOLVO RANGE EXTENDED C30 ELECTRIC

Volvo Cars is embarking on the development of a Volvo C30 Electric Range Extender variant of its electric vehicle, with additional range provided by a fuel cell. Volvo is working with PowerCell Sweden AB, a joint venture between AB Volvo and Statoil ASA in developing the fuel cell-based range extender. The concept integrates a fuel cell with an on-board reformer that was originally developed by Oel Waerme Institut in Aachen, Germany.

Using special catalysts operating at elevated temperatures, regular gasoline is converted into a hydrogen reformate to fuel the PowerCell fuel cell. The Volvo C30 Electric Range Extender can be filled up any gasoline station, and thus is not dependent on hydrogen stations. The reformer technology can be adapted for renewable fuels.

The PEM fuel cell being developed by Volvo will generate 30 kilowatts to power the car and recharge its lithium-ion batteries while driving. The fuel cell starts automatically when the battery is discharged to a predetermined level. While driving, the car is powered by the electric motor with energy supplied by the fuel cell, maintaining the battery charge. The battery provides maximum power for passing. In the Volvo C30 Electric Range Extender vehicles half of the batteries will be replaced by the PowerCell reformer/fuel cell system.

The range extending technology will increase operating range by up to 155 miles over the 93 mile range of the battery-only Volvo C30 DRIVe Electric. The result is about the same overall driving range as a conventional car.

Besides being quiet and vibration free, if a renewable fuel is used there are virtually no carbon dioxide (CO2) or nitrogen oxide (NOx) emissions. Sulfur oxides (SOx) and particulate matter are eliminated.

Volvo plans to have two Volvo C30 DRIVe Electric Range Extenders ready for real world testing in 2012 Beside the EREV application, PowerCell plans to supply its Power Generator reformer plus fuel cell stack to the pleasure marine and truck markets as an auxiliary power unit. — *Bill Siuru*

Fueling a greener America.

Around the globe, over 10 million natural gas vehicles are on the road today.

From consumer and fleet cars and taxis, shuttle and service vans, to trash trucks and transit buses, NGVs are valued for their low- to ultra-low-carbon performance. In America, NGV deployment by fleet operators is growing fast, as efforts to curb climate change intensify.

NGVs — already green and getting greener.
Use of natural gas fuel (CNG and LNG) significantly lowers greenhouse gas emissions — 30% in light-duty vehicles, and 23% in medium to heavy-duty models. Using renewable biomethane gas from landfill sources reduces greenhouse gas emissions by up to 90%.

Increasingly, natural gas fuel is derived from renewable sources.
Renewable biomethane is pipeline and vehicle fuel quality gas derived from biomass, which can be produced in large volumes. For example, the Clean Energy landfill processing plant near Dallas delivers 9,000,000 gasoline gallon equivalents (GGEs) of renewable biomethane fuel a year — fuel that can flow to Clean Energy natural gas fueling stations around the country — and that's just the beginning.

Committed to delivering green transportation solutions.
For more than a decade, Clean Energy has been dedicated to protecting the environment by providing clean, green natural gas fueling services for America. For more information visit us at www.cleanenergyfuels.com

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